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A CONCISE
ENCYCLOPEDIA
OF
WORLD TIMBERS

A
CONCISE
ENCYCLOPEDIA
OF
WORLD TIMBERS

A USEFUL WORK OF REFERENCE
FOR ALL USERS OF TIMBER
CONTAINING DETAILED DESCRIPTIONS
OF NEARLY 200 DIFFERENT TIMBERS,
WITH MACROSCOPIC IDENTIFICATIONS
OF THE WOODS IN MORE COMMON USE

BY
F. H. TITMUSS

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PREFACE

THE science of timber technology first came into prominence largely as a result of the investigations made by American research workers in the early years of the first World War. Before this time the normal wood consumer's knowledge of his material was chiefly empirical, and the results achieved by the scientists were neither appreciated nor fully understood by the practical man.

Since that time an extensive literature has grown up regarding timber of all species. Much of it has been of a "popular" nature, but some of the most important facts regarding correct utilization and identification are dealt with in books confined to the study of woods of a specific variety or some particular geographic region. The handbooks and pamphlets issued by certain nationally constituted bodies have done much to bring this knowledge to a wider audience, but it is true to say that even more could be done in this respect.

This volume has been designed, therefore, to serve as a connecting link between the laboratory worker and the man in the workshop and to be a handy reference book for all whose work necessitates a real understanding of timber. It cannot pretend to give an exhaustive study of each wood listed, but the data has been selected on the basis of its usefulness to all types of reader.

To do this, the book has been divided into two main sections.

The first describes in brief detail the growth of the tree, the anatomical structure of wood, and the features that lead to its correct identification. This introductory section is of considerable importance and should be read with care to gain the full benefit from the entries given for specific timbers in the second part of the book. A more detailed study of the anatomical structure of wood and its identification than it has been possible to give here can be found in works by the following writers: Baderder, Boulger, Brown and Panshin, Chalk and Rendle, Charpentier, Desch, Groom, Jeffrey, Jones, Kerner and Oliver, Koehler, McElhanney, Sargent, Stone. These authors' works are listed in the Bibliography.

The second section of the book treats with the details of different timbers of varying degrees of commercial importance. An alphabetical arrangement has been used here, the timbers being listed under their most commonly used trade name. In view of this arrangement it has not been thought necessary to include such names in the Index on page 151, and the Index accordingly shows the timbers only under their botanical and alternative trade names. It will be seen that details have been given of the macroscopic identification characteristics of many of the woods, but that more hardwoods than softwoods have thus been treated. This was necessary as identification by the hand lens of softwood timbers is more difficult than it is with the hardwoods, where differences of structure are more marked and where more positive identification can be made by the comparatively inexperienced.

Identification features are more likely to be of use to students and merchants than they are to the actual worker in wood, but all types of timber consumer will find the books mentioned in the Bibliography to be of interest. Here again, it has been possible to give only a representative selection from the very extensive literature. In addition to details of structure such items as recommended kiln-drying schedules, speed of machine tools, size of saw-teeth, physical and mechanical properties of the wood, are given in these books. Throughout this handbook frequent reference is made to authors whose books are listed in this Bibliography.

In conclusion the writer would like to offer his thanks to Mr. H. E. Desch, P.A.S.I., B.Sc., M.A. (Oxon), under whose instruction he learned that, quite literally, there is far more in wood than meets the eye, and also to Mrs. Ellen Wright for her assistance in the monotonous work of checking manuscript and proofs, and the compilation of the index.

F.H.T.

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INTRODUCTION

THE STRUCTURE OF WOOD, ITS IDENTIFICATION AND SOME ESSENTIAL DEFINITIONS

FROM the beginning of time Man has found in wood the answer to many of the problems of his existence. The material has always been readily available, and in many cases could be worked with the simplest of tools. Primitive Man found his earliest weapons in stout tree branches; the fires that warmed his cave-dwellings and kept animals at bay came from smaller branches and brushwood, and the first adventurers paddled their way across rivers and streams whilst perched precariously on floating logs. As civilization progressed, so did Man's knowledge of the useful material that Nature had supplied in such abundance. Better tools, greater skill in the handling of them, and a more accurate knowledge of the medium in which they worked, resulted in the craftsman in wood becoming one of the best known and most popular members of each succeeding civilization. The story is one of steady progress, and the story is as yet unfinished. Yearly, modern research workers find yet more uses for wood, and a list of the products that may come from a single forest tree reads like a mad scientist's dream. Timber is unique, and no substitute has been, or is likely to be, discovered to replace it for many essential purposes.

Regarding timber from the view-point of its usefulness as a building material and its more common uses, it might be thought that it holds few secrets. Yet it is true to say that the average craftsman or dealer in wood is surprisingly unaware of the true nature of the substance he handles so freely, and in nothing is this more apparent than in his attempts to classify and identify timber. For identification purposes reliance is placed on the most obvious factors such as the weight, colour, smell and figure (which is usually incorrectly called the "grain"). These factors are useful ones, but are not

necessarily reliable or constant, and in some cases (as, for example, when the timber has already been incorporated into a building, or has been treated with a preservative or staining agent that hides its figure) it may not be possible to apply such standards with any hope of success.

Under conditions such as those just described it is an easy matter for an unscrupulous dealer to pass off a cheap, inferior wood as a greatly superior variety, and in constructional work a not inconsiderable element of risk may be introduced by the use of such timber. Even if there is no deliberate intention to defraud, mistakes are possible that may lead to mechanical failure of the timber whilst it is *in situ*. In his own, and in his clients' interests, every dealer, builder and architect should be able to check the species of timber supplied to an order. As will be made clear, this can be done only by examination of the wood with a microscope or hand lens, a test possible even when only a small sliver can be taken for study. Those features of the wood that are visible to the naked eye or under a hand lens giving low magnifications are described as the "macroscopic" features, whilst those for which a microscope are needed are termed the "microscopic" features. In this book emphasis has been laid on identification by macroscopic characteristics, as such identification can be made without any extensive training.

In the correct utilization of timbers, too, far too much reliance is placed on commercial customs and "rules" that are not always based on a scientific foundation. Any worker (even of the most limited experience) who wished to make a hammer handle, for instance, would select a piece of Ash for the purpose rather than a piece of Fir. If asked why he chose the Ash he would probably say, quite correctly, that Ash "springs" better than Fir, and that in use the Ash handle would jar the wrist far less than a softwood handle would do.

This is all very well as far as it goes, but his knowledge is not complete unless he can go on and say *why* Ash is more elastic than Fir, for without this knowledge he is not in a position to choose a suitable substitute should the necessity arise, more especially if the timbers from which he has to make his choice have not been handled by him before. He will be at fault because he does not understand the structure of wood.

Other factors that affect the correct utilization of wood, such as preservative treatments and seasoning, are in general better understood by most timber users. With the recent advances in wood technology, however, and the number of volumes previously published that deal with the timbers native to various geographic regions, there is no longer any excuse for an inaccurate knowledge of commercial timbers, and it is hoped that this book, coupled with a study of the authors listed in the Bibliography, will encourage dealers, architects and others, to treat the subject in a more scientific manner than has been the custom hitherto.

The Growth of a Tree

When the seed of any tree germinates it sends up a shoot and the first layers of wood are built up round a minute *pith* (or *medulla*), which is comprised of thin-walled cells that are filled with protoplasm and sap. At the outset the pith is a soft substance, but later it may dry and completely wither, leaving a tiny hole in the centre of the tree. The actual growth is caused by the *cambium tissue*, which surrounds every part of the tree like a tight-fitting sheath. This tissue is immediately inside the inner bark, but cannot be seen either by the naked eye or under an ordinary hand lens. In width it is one cell wide, and the cambial cells that go to make up the tissue divide, either vertically or horizontally, to cause growth. The process is a continuous one during a growth season, each cambial cell first growing to its full size, and then dividing, new wood being deposited on the inside of the tissue and new bark on the outside of it.

The concentric layers of wood produced during a growing season are frequently clearly visible on the end of a log, the clearness of these rings varying according to the species providing the wood. In temperate climates these rings are produced once a year, and they have accordingly been called "annual rings" or "annual layers", but the term "growth rings" is to be preferred as being more accurate for all trees. An abrupt cessation of growth, such as might be caused by complete defoliation of the tree by caterpillars and similar pests, will result in the formation of "apparent" or "false growth rings" that may be mistaken for the true growth rings.

It is by means of the cells that the tree nourishes itself, for weak solutions of salts are taken up from the soil, are conducted upwards towards the *crown*, or leafy top, where the sap undergoes certain chemical changes due to the effect of sunlight, and then travels downwards again, through the inner tissues of the bark, passing into the cambium tissue where it undergoes further chemical changes into wood or bark. The cells have very thin walls and have tiny holes called *pits* on their sides to allow of the circulation of the sap. Only a few of the outer growth rings take an active part in the conducting of food, and these provide what is known as the *sapwood* (or, scientifically, as the *alburnum*) of the tree. This sapwood may be lighter in colour than wood nearer the centre of the tree, and at the time the latter is felled is much wetter than the more central wood. As new wood forms outside the old, the cells of the older wood die. The cell wall thickens before this happens, and slight chemical changes take place; the cells cease to conduct food, and they then become part of the *heartwood* (or *duramen*) that is usually darker in colour and more resistant to certain types of fungal and insect attack than is the sapwood.

From the foregoing it will be seen that a young tree may consist almost entirely of sapwood, and that the older the tree the greater will be the proportion of heartwood.

Thus, in a log 14 ins. in diameter, with a 2 ins. wide sapwood ring rather less than 52 per cent of the volume will consist of heartwood, whilst with a log 5 feet in diameter the sapwood, if of similar width, would account for only some 12 per cent of the volume.

There may be a marked difference in the rate of growth of a tree during different periods of any one growing season, and this has given rise to the expressions "early wood" and "late wood" (or "spring wood" and "summer wood" respectively) to denote wood that has grown in the first and second halves of a growing season, and this difference between early and late wood may be of importance in trying to establish the identity of a timber.

As with all growing plants, the tree may not make use of all its food material, and certain waste products are often to be found in the timber. Of these, resin, silica, and calcium

oxalate may all be of importance as a diagnostic feature, whilst the colour of the wood may also be affected by these waste products. Organic substances, such as resins, oleo-resins, etc., may also be responsible for the characteristic odours to be found in certain species of timber.

Softwoods and Hardwoods

All commercial timbers are divided into two classes, the *softwoods* and the *hardwoods*. This classification has nothing whatever to do with the weight or hardness of the wood concerned, but is based solely on its structure (e.g., Balsa, weighing on an average only 9 lbs. per cubic foot is easier to work by hand tools and has less surface hardness than Kauri Pine, which may weigh about 40 lbs. per cubic foot, but Balsa is classified as a hardwood and Kauri Pine as a softwood).

Trees are divided into two groups, the *Angiosperms* and the *Gymnosperms*.

The Angiosperm group contains all the trees that provide the hardwoods, and are those trees whose seeds are carried in a seed-case or in fruit; such trees bear true flowers. The group is sub-divided into (a) the *Monocotyledons*, the plants having a single seed leaf and (b) the *Dicotyledons*, those plants with two rudimentary leaves in the seed embryo. In general, commercial hardwood timbers are provided by the *Dicotyledons*.

The Gymnosperms are the *conifer* trees, usually evergreen, and cone-bearing; this group takes in all the commercial softwoods. It will be noted that the definition given above for trees producing the hardwood timbers goes rather farther than the hitherto generally accepted definition of "deciduous trees", as all hardwood trees (especially those from tropical regions) do not necessarily shed their leaves.

Softwoods

The foregoing explains in general terms how the tree grows, and we must now turn to a brief study of the differences in structure between the softwoods and the hardwoods.

We know that the tree must be composed of billions of cells, for they are so small that they cannot be seen with the naked eye or even with the help of a hand lens, though it is possible

to study individual cells under a microscope if they are separated out by the process of maceration. In the softwoods these tiny cells are shaped like tubes that have closed ends which are somewhat pointed. Cells are described as being either *fusiform* when they are swollen in the middle and narrow at the ends, or *tube-like*, when the cell is approximately the same diameter throughout. Softwood cells have the pits previously mentioned, to allow of food circulation, and the function of the cell is to conduct food and provide the mechanical rigidity of the tree at one and the same time. In such timbers these cells are called *tracheids*, and they are packed closely together parallel to the length of the tree or log. In the spring, cells with thin walls but relatively large cavities are formed (the early wood), whilst in the summer the cells have thicker walls with correspondingly smaller cavities (the late wood). It is the noticeable difference between the early wood and the late wood in some softwood timbers that defines the growth rings so well, and gives the timber the appearance of being built up of layers of wood when a log is examined in end-section.

The soft tissue responsible for the storage of food in the growing tree (as opposed to its conduction) is known as the parenchyma, and may be of two kinds, either wood parenchyma or ray parenchyma.

The *wood parenchyma* cells are small, have numerous pits, and form internal walls inside the original cells. All the wood parenchyma cells that result from one cambial cell are described collectively as a parenchyma *strand*, and these strands may be present in the wood in one or more of three ways, thus affording a useful identification feature. The Parenchyma strands may either be scattered haphazardly through the wood, when they are said to be of "diffuse distribution", in definite zones called "zonate distribution", or else as a distinct line or lines of cells marking the end of a season's growth, when it is called "terminal parenchyma".

The second type of parenchyma is *ray parenchyma*, and is made up from oblong-shaped cells that have thin walls with the customary pits. This tissue forms light lines that may be visible on the end-section of the log, running from the centre of the tree to the bark. These bands of ray cells (called simply rays, or sometimes *medullary rays*) do not necessarily start at

the middle of the log, but each one invariably continues outwards until it reaches the inner bark. Although present in softwoods, the rays are not of such diagnostic importance as they are in the hardwoods.

Most softwoods contain *resin canals* that are visible under a hand lens either as small light-coloured dots or tiny openings on the end-section of the wood. The resin canal consists of an actual hole that is surrounded by special cells called *epitheal cells* that secrete resin into the hole. The canal is lined by a complete sheath of epithelial cells, the name *epithelium* being given to the whole. These resin canals may be empty in old, dry wood.

Pitch pockets, which are longitudinal pockets of resin caused by some injury to the cambial tissue during the growth of the tree, are sometimes to be found in the softwood species.

Hardwoods

In the hardwoods different types of cell do the separate work of conducting food, giving structural rigidity, and storing food.

Those that conduct food are called *vessels* (or *pores*), that, when looked at in end-section under a hand lens, resemble small round or oval holes in the wood. Each individual vessel is called a *vessel member*, and originates from one cell in the cambial tissue. In the early stages the cell is completely closed, but later it swells out into a cylindrical shape open at both top and bottom. Each vessel is, in effect, a hollow tube, and a series of vessels, one above the other and side by side, provide a continuous column from roots to leaves of the tree, the conduction of the food being helped by pits in the vessel members similar to those in the tracheids of the softwoods. The end walls of the vessel members may be either completely absorbed at the time the vessel starts to swell into cylindrical form (in which case the vessels are said to have *simple perforations*) or else be incompletely absorbed so that thin bars of tissue connect the side walls of the vessel member; this last type of vessel perforation is described as *scalariform* or, less frequently, as a *lattice perforation plate*.

Apart from the perforations, the vessels are a good diagnostic feature according to their manner of distribution when the

wood is viewed in end-section. They may be scattered about the wood as single vessels (as in Horse Chestnut) when they are called *solitary vessels*; in radial groups or lines, either long or short (the term radial meaning to cross the growth rings in the same way as do the rays), and in clusters, as opposed to the radial groups. Radial lines or groups of vessels are normally found to be made up of a certain specified number of vessels, the number varying according to the species of wood. In some timbers, a combination of radial lines or groups and solitary vessels is to be seen, as, for example, in Lime, where the solitary vessels and the short radial groups can be clearly distinguished.

The size of the pores in the early and late wood of certain species also serves as a useful feature for identification purposes. In some timbers (*e.g.*, Ash, Alder, Oak and Mulberry) the vessels of the early wood are much larger than those of the late wood, with an abrupt change in size between the two classes, the larger vessels forming a more or less continuous ring to mark the boundary of the growth ring; such timbers are called *ring porous* woods. These timbers are invariably resilient and well adapted to resist suddenly applied loads, and are therefore eminently suited for tool handles and similar items. It is interesting to note that only a very few tropical hardwood timbers show a ring porous structure. Other timbers (*e.g.*, Maple, Sycamore, Pearwood and Birch) do not show this abrupt change in vessel sizes, and woods that show the end-sections of the vessels gradually decreasing in size are said to be of *diffuse porous* structure.

With most seasoned timbers the vessels in the sapwood are empty, having given up their food content during the process of drying, but in the heartwood the vessels may have become filled with solid or semi-solid deposits of growth-food waste. In addition, *tyloses* (or, in the singular, a *tylosis*) may be formed in these vessels. These are caused by the pressure exerted by adjacent cells, which causes the walls of the pits to be distended to such an extent that they completely block the inside of the cell. Under examination with a hand lens the tyloses show up as small glistening spheres, giving the general impression of minute bubbles. Timbers that have such tyloses are difficult to treat with wood preservatives, as the tyloses form barriers

that prevent easy impregnation by the preservative fluid, but, on the other hand, such timbers have a high degree of natural durability as the tyloses also act as a barrier against the hyphæ of wood-rotting fungi. Mulberry, Oak, Ash and Teak are four quite common timbers in which these tyloses are always to be seen.

On the two longitudinal surfaces of a piece of wood, known as the radial surface when cut parallel to the rays, and tangential surface when cut right across the log (or, in other words, the quarter-sawn and flat- or plain-sawn surfaces respectively of trade nomenclature), the longitudinal lines made by the columns of vessels may sometimes be seen, either with the naked eye or with the help of a hand lens. These lines are called *vessel lines*, and they also serve as an identification feature. For instance, vessel lines are visible only with a lens in Pearwood, are indistinct in West Indian Satinwood, are quite distinct in Mulberry, and in West Indian Locust are so distinct that they appear to the naked eye almost like coarse scratches. The vessel lines are sometimes thrown into greater prominence by the deposits in the vessels, as in the case with Cherry.

The cells that form the strengthening tissue of a hardwood are shorter than the tracheids to be found in the softwoods, and their ends are rather more pointed than those of the tracheids. They are called *fibres* in the hardwoods, and the strength properties of a timber depend largely on the percentage of such fibres to be found in it. They are called *septate fibres* when they have internal divisions, or *non-septate fibres* when these divisions are lacking, but as the examination of the fibres is largely a matter for the microscope, little attention will be paid to them in this manual.

As in the softwoods, the storage tissue of hardwoods consists of wood parenchyma of two kinds, wood and ray, and either or both may form a good diagnostic feature.

The wood parenchyma is of two types, *apotracheal* and *paratracheal*, each type being sub-divided into three classes.

The apotracheal type of wood parenchyma does not touch the vessels or vessel groups, and is sub-divided into *diffuse parenchyma*, where the parenchyma strands are scattered haphazardly through the fibres, *terminal parenchyma* where

the strands are put on at the end of a growing season, and metatracheal parenchyma where the strands occur in layers between the rays. In this last type of parenchyma the layers may be either broad or narrow, and may link up with adjacent layers, but nevertheless it still does not touch the vessels or vessel groups. All these different types of parenchyma may be found in the one piece of wood. Sycamore, Poplar and Hornbeam are examples of timbers showing diffuse, terminal and metatracheal parenchyma respectively, though the first named also has its growth rings marked by narrow lines of terminal parenchyma.

The second type of hardwood parenchyma, the paratracheal, is sub-divided into vasicentric, aliform and confluent parenchyma, all actually coming into contact with the vessels. *Vasicentric* parenchyma forms a complete or incomplete circle round the vessel (*e.g.*, Ash); with *aliform* parenchyma the sheath seems to have been pinched out at the side to form wings (*e.g.*, Purpleheart), whilst *confluent* parenchyma consists of a series of aliform shapes connected together, usually forming a wide band of parenchyma round the vessels, an arrangement such as is to be seen in West Indian Locust.

The second type of storage tissue is the ray parenchyma, but the rays of hardwoods are not only more in evidence than they are in the softwoods, but are also far more important as an identification feature.

Rays are classified into two main divisions, called *homogeneous*, when all the cells comprising them are of the same size (as in Indian Rosewood), and *heterogeneous* when the cells comprising them are of different sizes, examples of which can be seen in Teak. When ray tissue is laid on with a width of one cell only, the rays are described as *uniseriate* (examples are to be seen in Poplar) whilst rays two or more cells broad are described as *multiseriate* (examples to be seen in Birch). Occasionally ray tissue is to be found consisting of a large collection of rays with a few fibres scattered through the ray tissue. Such an arrangement is described as an *aggregate ray*, and rays of this nature may be found in Hornbeam.

In some woods the rays are to be seen longitudinally in more or less uniform rows of the same height, the rays being spaced very finely and usually indistinct except with the help of a

lens. Such an arrangement is very noticeable on the tangential (plain-sawn) surface of true Mahogany. The name of *ripple marks* has been given to this storeyed structure of the rays in hardwoods, and the presence or absence of them may be an important factor when attempting to identify a timber. Commercially, the rays are important in that timber sawn radially (quarter-sawn) shows the rays making an attractive figure across the wood, as with the so-called "silver grain" of Oak.

Both the wood and ray parenchyma cells may contain deposits of various crystals, and here again the presence or absence of such substances may help in the identification of the timber concerned.

Other features of importance in the hardwoods are the resin canals and pitch pockets briefly considered in the remarks on the softwoods above, but in the hardwoods these are only occasionally to be found, though in a few timbers they may be found horizontally in the ray tissue.

Pith flecks, which appear as small brown lines running in the direction of the grain, are caused by damage to the cambial tissue by the larvæ of a species of small beetle. Such pith flecks are very strongly marked in Birch, and are also to be seen in Poplar. They normally occur only in certain species.

A very few tropical hardwoods also show *latex* (liquid rubber) *canals*, and in some woods they may be very long in radial section and be of such frequency as to render the wood unsuited for structural use except in very small lengths. Economically, the importance of such timbers rests on the products that can be obtained from their latex as, for example, guttapercha.

The Naming of Timbers

The first difficulty likely to be encountered is over the actual naming of timbers. For instance, what differences, if any, are there in the nature of French, Spanish, English, Persian and Circassian Walnut? Does an Englishman and an American mean precisely the same timber when he speaks of a piece of Ash? Is Red Fir the same timber to all intents and purposes as Yellow Fir, and if so, why is it that both may be referred to as Northern Pine or Baltic Redwood?

The commercial nomenclature of timbers is both bewildering and unreliable, more especially in the naming of tropical

woods, for in the past the custom has been to describe a little-known timber by reference to some better-known wood, plus the addition of a geographic name, as, for example, "Rhodesian Teak", which is not a true Teak at all. The names Mahogany, Oak, Walnut and Maple, in particular, prefixed by the name of a country, district or colour, have been favourite ones for popularising local timbers to build up an export market, especially where the local timber bears some superficial resemblance to the true wood. In some instances no great harm is done, but it will be realized that this practice can easily lend itself to the passing off of inferior timbers as much superior varieties, when the inferior wood may have none of the characteristics of the timber after which it has been named, and may perhaps be entirely unsuitable for use under conditions in which the true timber would be invaluable. Latterly, however, there has been a tendency to make more use of local trade names rather than borrowed titles, which is a step in the right direction.

Yet this latter trend leads to an additional difficulty being created by having some common local name used to describe entirely different timbers in other parts of the world. In Africa a certain timber is named "Yellowwood", whilst in Australia the same name is given to a totally different wood, a confusion that is made worse by the fact that one timber is a botanical softwood and the other a hardwood.

Scientists have overcome the difficulty of nomenclature by adopting botanical names. Trees have been carefully divided into families according to their characteristics, and subdivided into genera, the tree being described by a two-part name that gives the genera followed by some specific description, the whole being in Latin. The specific epithet may be either a proper name, or may describe the colour, type of leaves and so on.

As an example, take the four timbers known commercially as American White Oak, American Red Oak, Turkish Oak and Evergreen Oak. These would be described by a botanist as *Quercus alba*, *Quercus rubra*, *Quercus cerris* and *Quercus ilex* respectively, the names thus indicating that they belong to a common genus and consequently share certain characteristics. Reverting to an example previously quoted, the botanical name of

Rhodesian Teak is *Baikoea plurijuga*, which shows that the timber is not of the same genus as that of the true Teak (*Tectona grandis*), and that consequently the two timbers may have quite dissimilar properties.

It is not possible (or perhaps even desirable) to try to substitute a botanical for the commercial nomenclature of timbers, but with the aid of the former it is possible to verify and compare laboratory tests on timber that may have been carried out in widely scattered parts of the world without the confusion that is very likely to arise through the use of local or trade names. The practice of including the botanical name of a timber in brackets after the trade name, when drawing up a specification, is gradually increasing and will do much, if generally adopted, not only to check possible attempts at fraud, or negligence, but also to ensure that timbers are more correctly utilized. In Section II of this book botanical names have been given in italics, as well as the better-known alternative commercial names. With the help of these it is possible to select alternative timbers for specific purposes.

The Identification of Timber

We may now consider the study of a piece of timber with a view to its identification, and follow this by a discussion of the preparation of a "key" to enable the timber to be correctly named when its structure has been made clear.

The timber to be examined is cut across the transverse section (end-section), using a very keen knife and making a single clean cut along the rays from the direction of the outside of the wood towards the pith or centre. The structure can then be examined closely with the aid of a hand lens that gives a magnification of about ten diameters, and notes should be made of the structure thus revealed. Such important items as the relative size of the vessels, arrangement of the vessels either in ring porous or diffuse porous formation, groups, chains or solitary vessels, presence or absence of gum ducts, vessel deposits, tyloses, and the type or types of wood parenchyma present are all important points, and should be carefully noted. References to the appearance of vessel lines and the presence or absence of ripple marks on longitudinal surfaces are also useful.

After such an examination of a specimen, a description of the timber along the following lines might be available.

"Ring porous structure. Very distinct growth rings, the boundaries being marked by large vessels and layers of terminal parenchyma. Vessels are oval in end-section and variable as regards their size; some are solitary and some are in short radial groups, all have simple perforation plates. The vessel lines are coarse and quite distinct to the naked eye. There is a certain amount of diffuse metatracheal wood parenchyma but considerably more vasicentric parenchyma. No ripple marks are to be seen, nor are there any pith flecks."

The above is not a complete description of the structure as it could be revealed, but is sufficient to show the points that should be brought out by the examination.

Where the identity of a timber is suspected prior to its being examined, it is a simple enough matter to check the structure with the data published for that timber, and thus prove or disprove its identity, but where the identity is in doubt from the outset, reference to a *key* is necessary.

The principle underlying what is called a *dichotomous* key can be understood quite easily, for identification is arrived at by a process of elimination by working through a series of questions, the questions being arranged in pairs.

As a simple example let us suppose that the first group of two questions calls for an answer as to whether vessels are present or absent in the wood under examination. There can be only a straightforward "yes" or "no" and, as will be appreciated from the notes on structure given above, the wood is identified as a hardwood if the vessels are present, or as a softwood if they are lacking.

Each section of the key carries a reference to a later section. Suppose that it has been decided in our imaginary examination that vessels were present in the specimen. After the words "Vessels present" in section 1 of the key might appear "(see section 7)". On reference to that section we are faced with the alternatives "(a) Ripple marks present (see section 29)", and "(b) Ripple marks not present (see section 32)". Assuming that ripple marks were visible, we would pass on to section 29, but, as can be seen, by that time we would already have

eliminated from consideration all the softwoods and all the hardwoods that do not show ripple marks. The process of elimination would then be continued until the final question indicated the identity of the timber being examined.

We can take a very simple example of how this type of key works, assuming that we have a piece of Sandalwood (*Santalum album*) that we wish to identify. We must assume that the identity of the timber is unsuspected, but that it is known to be one of a group of ten timbers that includes Sandalwood. The other nine timbers are common Ash (*Fraxinus excelsior*); Boxwood (*Buxus sempervirens*); Deodar (*Cedrus deodara*); Yew (*Taxus* species); Honduras Mahogany (*Swietenia mahoganii*); Teak (*Tectona grandis*); Honduras Rosewood (*Dalbergia stevensonii*); English Oak (*Quercus robur*), and Douglas Fir (*Pseudotsuga taxifolia*.) The number of timbers has been limited to keep the key easy of explanation.

Turning to section 1 of the key covering these ten timbers we find:—

1. . . . (a) Vessels present? (see section 2).
- (b) Vessels not present? (see section 3).

Examination of the structure shows that vessels are present in the specimen, so the softwoods Deodar, Yew, and Douglas Fir are automatically eliminated from consideration. We pass on to section 2, which may read:—

2. . . . (a) Ring porous or tendency to ring porous structure present? (see section 5).
- (b) No tendency towards ring porous structure? (see section 7).

Our sample shows a positive diffuse porous structure, thus eliminating Ash, Teak, Oak, and Honduras Rosewood, the three former timbers all being most definitely ring porous in structure, whilst Honduras Rosewood shows a tendency towards being ring porous.

Section 7 offers us:—

7. . . . (a) Ripple marks present? (see section 11).
- (b) Ripple marks not present? (see section 15).

Ripple marks are not present in the specimen we are examining, and Honduras Mahogany is thereby eliminated. Passing on to section 15 we would find (for this particular key):—

- 15 (a) Occasional tyloses present? . . . Sandalwood.
(b) Tyloses not present? . . . Boxwood

As our sample has a few tyloses, it is thus identified as being Sandalwood.

It is not pretended that the above is a full key, or even the best for the ten timbers concerned. For instance, no account has been taken of the arrangement of vessels, vessel lines, gum deposits, rays, etc., but it has served as an example of a dichotomous key, and it will be noted that such items as weight, colour, etc., that might be variable, have had nothing to do with the identification, which has been based on structure alone.

With the hundreds of commercial timbers available, no completely satisfactory key of this nature can be published that will cover them all, and each worker should therefore prepare his own key, incorporating in it only those woods that he is likely to encounter in his professional capacity. Dichotomous keys for various groups of timbers are, however, included in various publications.

For the person who may need to identify some hundreds of different timbers the dichotomous key is not as valuable as the *Paramount Card Key*. This consists of a series of cards of standard size, one card being prepared for each timber. Round the edges of the cards various headings are printed in an unvarying order, the card being made up with a series of punch holes and cuts according to the published data for that timber. Identification is made by passing a pricker through a hole in the cards corresponding to the feature observed in the specimen, all unwanted cards (*i.e.*, those whose timbers do not show that feature) being discarded by shaking the pricker. The pile of cards diminishes as each feature observed in the specimen is checked through with the pricker until finally one card only is left, this card being that of the timber thus identified. Suitably printed cards for this patented device are readily obtainable.

Before any attempt is made to classify timbers of which the identity is doubtful, some practice should be obtained with known timbers, the structure revealed under the lens being compared with the printed data so that the various types of

parenchyma, vessel arrangement, and so on, can be recognised on future occasions.

Some Essential Definitions

It will be advisable to lay down certain hard and fast definitions of some terms that are constantly misused by most workers in wood, for unless such definitions are accepted and properly understood the description of a timber is made unnecessarily complex, and may lead to errors in identification.

Grain. The word grain, more than any other, is productive of continual misunderstanding owing to the looseness with which it is used. For the purpose of the study of timbers grain has nothing whatsoever to do with the appearance of the wood, and means merely the direction of the fibres relative to the axis of the longitudinal surface of the wood under examination.

Straight grain indicates that the fibres run parallel to the vertical edges of the tree.

Diagonal grain shows the fibres inclined to the edge of the wood. This may be a serious defect (as it has a considerable weakening effect), and is brought about by sawing the wood diagonally in the timber yard.

Spiral grain is where the fibres occur either in clockwise or anti-clockwise spirals (another source of structural weakness).

Irregular or Cross-grain refers to the disarrangement of grain round knots.

Interlocked grain Where successive layers of fibres are inclined in different directions the grain is said to be interlocked, and timbers showing this feature are difficult to work with hand tools and exceedingly difficult to split radially. Interlocked irregular grain produces what is known as *roe figure*. Timbers having an interlocked grain show a banded or striped effect on quarter-sawn stock, the striping varying according to the degree of interlock present.

Wavy grain causes the popular "fiddle-back" figure.

Figure may be defined as the pattern on the wood and is produced by such things as the colour difference between the early and the late wood, heartwood and sapwood, and the pattern made by the growth rings as seen on the longitudinal surfaces, as well as the actual nature of the grain.

Texture is another word that is frequently misused, but when used correctly it refers to the prevailing size of the cell cavities. Thus, Greenheart is said to have a fine texture because the vessels are small in end-section, whilst Oak is said to be of coarse texture because its cell cavities are relatively large. Texture may range from very fine to very coarse according to the species of wood, and may also be described as "even" (or "uniform") or "uneven", the difference being that uneven texture is to be seen in woods in which there is a marked contrast between the early and the late wood (as in the ring porous woods), while where no such difference exists the texture is said to be even, or uniform.

Durability. This refers to the natural capabilities of the wood to withstand most types of insect and fungal attack, and not to its power of withstanding mechanical wear. Thus, a timber suited for use as a heavy duty flooring is not necessarily durable, as it may readily succumb to insect or fungal attack if exposed to conditions favourable to their development. Similarly, certain species of timber may be immune to certain types of insect attack, but they are not classed as durable unless they show high natural resistance to other types of attack. Durability is normally increased by wood preservative processes.

Working Qualities. It is obvious that from a labour point of view it is easier to work any timber by machine than it is by hand. In such a context as "easy to work, whether by hand or by machine" the last three words should be taken as indicating that the wood does not show such annoying features as a tendency to "ride" or "chatter" when being machine-planed, rapidly blunt saw-teeth, and so on.

Weight. The weight of any given species of timber will vary according to the conditions under which it was grown, the soil, its position in the tree, age, and many other factors. Thus there may be a range of some ten pounds difference to the cubic foot for varying samples of the same species. The mean of the two figures quoted in the entries on the different timbers may be taken as a fair average weight for most samples. Most weights are given "air dry", that is to say, when seasoned to the prevailing atmospheric conditions.

"Movement" or "Working" is the slight expansion of timber

caused by its absorbing moisture from the surrounding atmosphere and consequently swelling, even though the wood may be seasoned. Some species are more prone to movement than are others, those woods in which there is little movement being described as stable. Woods showing a high degree of stability are essential for certain specialized purposes such as pattern-making.

Degrade is a lowering of quality caused by warping, cracking or splitting during a seasoning process.

Collapse is a rupture of cell wall material caused by incorrect kiln seasoning treatments. Some species are more liable to this defect than others (*e.g.*, Balsa).

Typical uses for timber. It has, of course, only been possible to indicate a very few of these for each timber, and many of these uses are those for which the timber is employed in its country of origin. Economic considerations might rule out some of these uses where the wood has to be transported some considerable distance, an alternative local timber being found equally useful for the desired purpose.

Description and Identification

Acacia

This timber is provided by species of *Acacia* of the Leguminosæ family. The genus is very widely distributed, and the timber of many different varieties are to be found in commercial consignments of the wood, though specific varieties may be sold under special names (*e.g.*, *Acacia melanoxylon* reaches the market as Australian Blackwood). It is a coarse textured hardwood, reddish-brown in colour, sometimes showing a figuring of dark streaks, and is a strong and elastic timber that may be used for the making of tool handles, vehicle parts, walking sticks, and turned articles. Acacia is not an easy timber to work, whether by hand or in machine operations, but it may be brought to a good surface and it also turns well; in general it responds well to normal finishing treatments. The seasoning qualities of the wood are good and the rate of degrade low. Weight per cubic foot is variable according to species. The timber is naturally resistant to wood-rotting fungal attack, but the sapwood is liable to infestation by powder-post beetles. Supplies would seem adequate to meet the present demand.

Alder

Differing species of *alnus* of the Betulaceæ family go to make up consignments of this timber. The tree is common in Britain and the northern parts of Asia and America, and it produces a straight grained fine textured hardwood that is well known on all the world markets. The timber may be marketed under the description of "Grey", "White" or "Red Alder", according to species, but in general the wood ranges from light to reddish-brown in colour, with a lustrous surface, and weighs some 30 to 40 lbs. to the cubic foot when in an air dry condition. Alder is, in general, durable for most of the purposes for which it is employed; most of the species are noted for their durability under water, but *Alnus incana*, frequently included in commercial consignments of Alder, is not so satisfactory in this respect. The wood seasons without undue difficulty, and is reasonably stable once that process

is completed. It works easily, with very little dulling effect on tools, stains and takes the usual finishing treatments well, and may be used for such purposes as cabinet and furniture making, plywood manufacture, shoe heels, clogs, bobbins, wooden cogs, and small turned items. Sap-stain fungal infection is somewhat common with the species, and evidence of its attack may be present in the converted wood. For the related North American species see the next entry, whilst for a full study of this timber see books by Chalk and Rendle; Howard; Stone.

Macroscopic identification features of Alder

Diffuse porous structure. Growth rings not very distinct to the naked eye, and sometimes having a wavy outline. Vessels small; distinct under a hand lens but scarcely, if at all, visible to the naked eye; solitary, and also in radial rows or groups; tyloses not present; scalariform perforation plates are present. Vessel lines just visible to the naked eye. Rays are homogeneous; aggregate rays may be present, and if so are distinct to the naked eye; crystal deposits fairly common. Sparse paratracheal wood parenchyma; variable amount of metatracheal parenchyma of diffuse distribution; terminal parenchyma may also be present on the borders of the growth rings. Ripple marks not found in the species. Pith flecks are abundant and are visible to the naked eye on longitudinal surfaces.

Alder, Western

Although sometimes sold under this distinctive name this timber (the product of *Alnus rubra* of the Betulaceæ family) is most likely to be found in miscellaneous consignments of Alder. It is also sometimes sold as Oregon Alder or Red Alder. An average specimen of Western Alder weighs rather heavier than does one of common Alder, and in colour the American timber may range from a pale yellow to reddish-brown, with an indistinct figuring. The tree providing this particular wood has its natural habitat on the Pacific coast, and the timber is a useful non-ornamental cabinet wood that is largely used for furniture making and turning. Western Alder is not a naturally durable timber when exposed to the attack of

wood-rotting fungi, but is durable for use under water. It works satisfactorily in all hand or machine operations, and responds well to most types of finishing treatment. No specific demand exists for the wood under this particular name, and no demand is likely to arise in the future.

Macroscopic identification features of Western Alder

These conform with those of the preceding timber, and positive differentiation is not possible with the hand lens.

Almond

A commercial and botanical hardwood timber coming from *Prunus amygdalus* of the Rosaceæ. Commercially, the tree is far more important for its fruits than for its timber, and so far as the latter is concerned supplies are more than adequate to meet the present demand. Reddish in colour, and with a light, lustrous surface, the grain may be either straight or irregular, but the texture is fine and uniform. It is not a naturally durable timber for use in exposed positions, but is durable for all purposes under cover; it is not one of the class of timbers normally given a wood preservative treatment. In most hand and machine operations Almond cannot be classified as an easy timber to work, but it may be brought to a good surface, and also carves and turns well. The wood seasons readily without a high rate of degrade, and is suitable for inlaying, small turned articles, and fine cabinet work. The tree is common in Europe and East Africa, but even under the most favourable conditions it grows only to a height of some 30 feet, and more commonly may reach only half that height; the wood is thus available only in small sizes. Apple and Cherry are two species that are closely allied to the Almond, and the three timbers have, therefore, much in common.

Macroscopic identification features of Almond

Diffuse porous structure. Growth rings not markedly distinct. Vessels small in size; some solitary, and others in radial lines or groups; simple perforations; gum deposits rather common. Vessel lines may be quite distinct to the naked eye if abundant gum deposits present. Rays all of one size; not always clear to the naked eye; rather broad, and somewhat

conspicuous on the radial surface. The wood parenchyma is not to be seen, even under a hand lens. Ripple marks are not found in the species. Occasional pith flecks may be found.

Aloes Wood

This is the product of *Acquilaria agallocha* of the Thymelaceæ family, and may reach the market under such names as Paradise Wood, Eagle Wood, or Calambac. The timber comes from a tree of tall growth habit that is native to China, Malaya, and other parts of tropical Asia. Nowadays the wood is not well known on the world markets, though formerly it was in great demand for inlaying and similar work. Aloes Wood is an easy enough one to work, but needs pre-boring before nailing or screwing as it has a very marked tendency to split. Under seasoning treatments it may check badly, and it is also subject to chemical stain during that operation. The sapwood of the species is whitish in colour and has no commercial importance, but the heartwood is dark coloured, with a beautiful and distinctive figuring and a fragrant, resinous smell. Average specimens weigh between 20 and 30 lbs. to the cubic foot when air dry, the grain is straight, but the texture medium coarse. Botanically the timber is a hardwood. No increase in the limited demand for this timber seems likely, though supplies are not abundant.

Apple

Like the Almond, the Apple tree (*Pyrus malus* of the Rosaceæ) is economically more important for its fruits than for its timber, the more so as the tree may live and bear fruit for more than 150 years. The tree is a very common one, but reaches its best development in the colder parts of the temperate zones. Although not greatly used for external work, the timber is naturally resistant to the attack of wood-rotting fungi. It is rated as hard, and is somewhat difficult to work by hand, but it is an ideal timber for carving and it also turns well. Apple responds very satisfactorily to the usual types of finishing treatment given to a non-ornamental cabinet wood, and in particular it polishes well. In general appearance the wood closely resembles that of the Pear, having brownish-pink or light reddish coloured heartwood. The grain is normally

irregular (sometimes sufficiently so to cause difficulty in machine planing), but the texture is fine and uniform. Average specimens weigh between 40 and 50 lbs. to the cubic foot.

Ash

This European timber, sometimes called Common Ash or European Ash, is the product of *Fraxinus excelsior* of the Olaceæ family, and is one of the hardwoods most commonly to be found on the world markets. It is more variable in weight than the average run of timbers, weighing between 40 and 53 lbs. to the cubic foot when in an air dry condition. The grain is normally straight, but the texture somewhat coarse. Ash is a tough and elastic timber and one that is reasonably durable, although the sapwood appears rather susceptible to powder-post beetle attack. It is a moderately easy wood to work though its uneven texture may cause a certain amount of trouble in surfacing by the machine planer, but its dulling effect on tools is not considerable. The wood bends very well, and turns satisfactorily for a timber of its unevenness of texture. Typical uses include the making of ladders, hammer and tool handles, spokes, oars, poles, camp furniture, gymnasium equipment, coffins, garden furniture, stretcher handles, vehicles, artificial limbs, and other purposes for which a resilient but reasonably light timber is needed. In colour the wood may range from white to lightish brown, and there is a very pronounced figuring. For detailed studies of Common Ash, together with microphotographs of its structure, see Chalk and Rendle; Pearson and Brown; Winn. The North American species of Ash is dealt with below, whilst another timber that occasionally reaches the market in small quantities is the Black Ash (*Fraxinus nigra*), though this last wood is not regarded as being as good as the other commercial species.

Macroscopic identification features of Ash

Ring porous in structure. Growth rings usually distinct to the naked eye; boundaries indicated by the large vessels of the early wood, and by layers of terminal parenchyma. Vessels variable in size, largest being distinct to the naked eye; oval in end-section; solitary, or in short radial groups; tyloses not present; simple perforations. Vessel lines coarse; distinct to

the naked eye. Sparse metatracheal type of wood parenchyma, diffuse in distribution; terminal parenchyma marking growth rings; abundant vasicentric parenchyma surrounding the vessels. Ripple marks not present in the genus.

Ash, White

There is little essential difference between the structure and nature of this North American timber (the product of *Fraxinus americana*) and that dealt with in the previous paragraph. White Ash averages out as slightly the heavier of the two timbers (45 to 58 lbs. to the cubic foot), and the light brown to reddish-brown timber has a rather more pronounced colour difference between the early wood and the late wood than is the case with the European species. Working and seasoning qualities of White Ash are approximately the same as those of Common Ash, and being rated as moderately durable it is used for the making of shop fittings, gymnasium equipment, athletic goods of all descriptions, spokes and other parts of vehicles, tool and hammer handles, and all the purposes for which Common Ash may be used. The wood sometimes reaches the market under the alternative names of American White Ash or Canadian White Ash. For a detailed study of this timber works by the following authors may be consulted: Chalk and Rendle; McElhanney; Sargent.

Macroscopic identification features of White Ash

For these see the remarks under the previous entry, as both timbers conform closely to the characteristics of the genus.

Balsa

This is the lightest of all woods to find any commercial use, averaging only between 6 and 12 lbs. to the cubic foot when air dry, but botanically it is classified as a hardwood. The wood is the product of various species of *Ochroma* of the Bombacæ family, and is straight grained and coarse textured, being white, pinkish-white or brownish-white in colour, and having a somewhat lustrous surface. Being soft the edges of the wood have a tendency to crumble under dull tools, and the same weakness is responsible for the fact that the nail and screw holding properties are far from good. Glue adheres well,

however, and the wood may also be stained and polished with satisfactory results. The lightness of Balsa has led to its being extensively used for floats, etc., but as it is not a naturally durable wood it is given special wax treatments before being used for such purposes; it very readily succumbs to fungal attack. The limited uses for the timber include thermal and acoustic panelling, aircraft work, and toymaking (more especially aircraft modelling). Under kiln seasoning or wood preservative treatments the timber is apt to collapse, though it seasons quite well in air. A full detail of the properties, structure, etc., of this timber is given by Record and Mell.

Macroscopic identification features of Balsa

Diffuse porous in structure. Growth rings lacking or only very poorly marked. Vessels large and visible to the naked eye; solitary in distribution; vessel lines distinct to the naked eye. Rays normally distinct to the naked eye on transverse section and tangential surfaces, and very conspicuous on the radial surface. Wood parenchyma not visible to the naked eye, and not to be seen even under a hand lens. No ripple marks present in the species. No pith flecks. It can be noted that identification of this timber can nearly always be made quite safely on the basis of its weight alone.

Basswood

The timber of *Tilia glabra* is closely related to the European Lime, which it resembles in appearance, but it is the product of a North American tree that may grow to a height in excess of 100 feet. This timber should not be confused with that of American Whitewood (*Liriodendron tulipifera*), which also passes under the name of Basswood in certain markets. The timber is a hardwood, weighing between 23 and 30 lbs. to the cubic foot when air dry, and is straight grained, with a fine and uniform texture; it may range from a creamy white to a lightish brown in colour, but there is no distinctive figuring. During seasoning processes the wood shrinks very considerably, but once that operation has been completed the wood is remarkably stable and is well suited for such purposes as pattern-making, where freedom from "working" is of importance. Basswood is not a naturally durable timber, and is very

susceptible to pinhole borer attack, but it is easily treated with wood preservatives. The timber works easily, finishes smoothly, and carves and turns well. Its greatest importance is on the American market, but it is imported into this country in the form of square-edged timbers. In addition to pattern-making, some typical uses for Basswood includes the making of musical instruments, mouldings, picture frames, match splints, boxes, crates, drawing boards, plywood, wood sculpture, turnery, and certain classes of athletic goods. For more detailed studies of the timber see Cox; Hale; McElhanney.

Macroscopic identification features of Basswood

Diffuse porous in structure. Growth rings fairly distinct to the naked eye, and undulate slightly between the rays. Vessels very numerous, but small in size; open; distributed in tangential lines or groups; simple perforations. Rays fairly distinct to the naked eye. Metatracheal type of wood parenchyma in short bands. Little contrast between the early wood and the late wood, and no characteristic taste or smell.

Beech

This is one of the best known and most useful commercial hardwoods in the world, and is the product of *Fagus sylvatica* of the Fagaceæ family. A steady demand exists for the timber, but in normal times there does not seem to be much difficulty in meeting that demand. Beech averages between 45 and 55 lbs. to the cubic foot when in an air dry condition; it has a straight grain and a fine and uniform texture. Its colour ranges from a whitish to a light reddish-brown. The timber is easy working, and its dulling effect on tools is almost negligible; it bends well and is an excellent wood for turnery purposes, and it also reacts well to the customary types of finishing treatments for a wood of its nature; pre-boring is advisable for nailing or screwing as it is rather brittle. It is only moderately durable when used in conditions favourable to the development of wood-rotting fungi attack, but it is sufficiently durable for most purposes under cover. Typical uses include the making of pulley blocks, tools and tool handles, furniture, athletic goods, gymnasium equipment, cabinet-making and turnery. For further information regard-

ing this timber see books by Chalk and Rendle; Howard; Winn. The closely-related North American species comes from the *Fagus grandiflora*, which produces a timber that is both heavier and harder than its European counterpart. Like the European timber, it is rather difficult to handle under seasoning treatments, and the rate of shrinkage during the process is high. In America the wood is commonly used for heavy-duty flooring.

Macroscopic identification features of Beech

Diffuse porous. Growth rings reasonably distinct to the naked eye; boundaries marked by narrow rings of denser late wood; growth rings curve out slightly between the rays. Vessels small; normally not visible to the naked eye, but distinct under a hand lens; many in number; variable in shape; simple perforations. Rays heterogeneous; multiseriate rays conspicuous on transverse section and radial surfaces; finer rays indistinct to the naked eye, but usually distinct under a hand lens. Ripple marks not present in the species. Pith flecks are present. No distinctive odour or taste.

Beech, Antarctic

A straight grained hardwood with a fine and uniform texture, the heartwood of which is a light pinkish-brown in colour; the wood has no characteristic taste or smell. Average specimens (air dry) of the timber weigh between 45 and 50 lbs. to the cubic foot. The tree producing the timber (*Nothofagus moorei*) is a member of the true Beech family, though the particular genus to which it belongs has its members confined to the southern hemisphere. Although the importance of the timber is largely local, a small export trade is done with the general world markets. Antarctic Beech is a strong timber, the working qualities of which are much the same as those of the preceding timber, and its durability and seasoning qualities, too, are very much on a par with those of common Beech. The prominent ray figuring that is so characteristic of the *Fagus* species is missing in the *Nothofagus* species, a fact that provides an easy means of distinguishing them. Antarctic Beech may be used for brush stock, flooring, cabinet-making, and most of the uses detailed for ordinary Beech. A closely related species is the Southland Beech (*Nothofagus menziesii*).

Macroscopic identification features of Antarctic Beech

Diffuse porous in structure. Growth rings not distinct to the naked eye, the boundaries being poorly defined. Vessels small to minute in size, very numerous; solitary, and in short radial chains; simple perforations. Vessel lines not conspicuous nor distinct to the naked eye. Rays heterogeneous; not visible to the naked eye but visible under a hand lens; not prominent on radial surfaces. Wood parenchyma not visible to the naked eye, and not very distinct under a hand lens; scanty; mostly terminal but also some diffuse type of parenchyma; crystals present in wood parenchyma cells. No ripple marks. The identification features of Southland Beech are very similar.

Beefwood

The tree providing this timber (*Casuarina equisetifolia*) is one of rapid growth habit that is native to various parts of Australia, the Malay Peninsula, Burma, and adjacent regions. It is a hardwood that has an average weight of between 55 and 65 lbs. to the cubic foot, with a grain either straight or shallowly interlocked, and the texture moderately coarse but even. The heartwood may be red or run through various shades of red-brown in colour, and, according to the degree of interlock grain present, quarter-sawn stock may show a stripe figuring. The timber is a rather difficult one to work by hand, and is classed as refractory under seasoning treatments as it is very apt to split during drying treatments, both in air and kiln processes. It is not a naturally durable timber when exposed to the air or when it is in contact with the soil, and it is only rated as moderately durable when protected from the elements. Although enjoying a certain amount of local importance the timber is never likely to become an important factor on the general world markets. Typical uses for the wood include posts, rafters, mining and structural timbers, and so on. Many detailed studies of Beefwood have been made by Australian writers.

Benteak

This timber may sometimes be offered for sale under its alternative name of Nana. It is closely related botanically to

Pyinma (see below) and is far better known and appreciated in India than it is ever likely to be on the world markets in general, largely because of the difficulty of exploiting the wood. The tree producing the timber is the *Lagerstromia lanceolata* of the Lythraceæ family. An average air dry specimen of the wood weighs between 40 and 50 lbs. to the cubic foot, and is straight grained, though the texture is somewhat coarse. The heartwood of the species is a light red to a reddish-brown in colour, darkening with age to a uniform dark brown, and having a lustrous surface but no distinctive figuring. It is rather a difficult timber to season, and the rate of degrade caused by end splitting or warping during that operation may be high. The timber is only moderately durable when exposed to the effects of the weather and is said to be difficult to impregnate with wood preservatives. Benteak works easily and well, in all hand or machine operations.

Birch

Birch provides one of the best known of the world's timbers. It is a hardwood timber that comes from a tree (the *Betula alba* of the Betulaceæ family) that is of rapid growth but only medium height, and one that is of common occurrence in the north temperate zone. The timber now being described is the common English species, the closely-related North American species being dealt with below. The wood is lightish to a very light brown in colour, with straight grain and a fine and uniform texture, weighing between 35 and 48 lbs. to the cubic foot when properly air dry. Birch is not a naturally durable timber for use in exposed positions, but it works exceedingly well under hand or machine tools, and finishes smoothly to a good surface; the dulling effect on the tools is almost negligible. The timber polishes satisfactorily and its characteristic lack of colour and figuring makes it a useful wood for staining for the purpose of imitating a more rare or superior wood; it also turns very well and bends satisfactorily. Amongst the uses to which Birch may be put can be mentioned plywood manufacture, boat and canoe building, fish casks, hoops, shoe heels, kitchen furniture, dowels, chair- and cabinet-making. In this country the Birch tree grows only to an average height of some 30 feet, hence large timbers are not

readily available, but in addition to the two North American species listed below, the Cherry Birch (*Betula lenta*) and Black Birch (*Betula nigra*) both attain heights more than twice that of the English species, and are equally as suitable for timber in all respects. For a study of the timber of English Birch see Chalk and Rendle; Howard; Winn.

Macroscopic identification features of Birch

Diffuse porous in structure. Growth rings not distinct to the naked eye; boundaries marked by terminal parenchyma and darker zones of the late wood. Vessels solitary, or in small radial groups; small; normally not visible to the naked eye; but distinct with the help of a hand lens; uniform distribution, scalariform perforations. Vessel lines visible to the naked eye. Rays very fine or fine; distinct under a hand lens on transverse section, but not distinct to the naked eye. Terminal parenchyma marking growth rings present; scanty paratracheal type of parenchyma and metatracheal type of parenchyma also present. Ripple marks not present. Pith flecks reasonably abundant.

Birch, Canadian Yellow

This, in common with every other true Birch, is a member of the same botanical family as the Alder, and has much in common with that timber. It is a hardwood, and may reach the market under such names as Quebec Birch, Yellow Birch, or Canadian Silkywood. It is a straight grained, fine and uniformly textured wood, provided by the *Betula lutea*. It is normally rather heavier than the English species, the weight varying between 40 and 48 lbs. to the cubic foot, and the wood ranges from light to dark reddish-brown in colour; it has no characteristic taste or smell. The shrinkage factors of the wood are on the high side, but it seasons well and without serious degrade. It is a naturally durable timber only when used in positions protected from the weather and soil, but it may be easily and satisfactorily treated with wood preservatives. Its working qualities are rather similar to those of European Birch, being, if anything, slightly harder than that timber and consequently rather more difficult to work. Typical uses for the timber include cabinet-making, veneering, parquet flooring,

dowels, gymnasium equipment, turnery, chair-making, and similar work. The wood may be regarded as the North American equivalent to European Birch in all respects, and is frequently imported into this country in the form of square-edged timbers. For the literature on this particular wood see Cox; Howard; McElhanney.

Macroscopic identification features of Canadian Yellow Birch

Similar to those of common Birch (see above).

Birch, White

As with all the true Birches, this timber is the product of a tree of rapid growth habit. It is common in various parts of the North American continent (where it may also be known as Canoe Birch or Paper Birch) though it does not exist in such ready availability as does Canadian Yellow Birch; it is the product of *Betula papyrifera*. Supplies of the timber are, in normal times, frequently seen on the United Kingdom markets, and it is imported not only in the form of square-edged timbers, but also as squares for turning, and as dowels. The shrinkage factors are lower with White than with Yellow Birch, and in consequence the former timber seasons with less difficulty and a lower rate of degrade. White Birch is rather easier to work, whether by hand or by machine, than the majority of the commercial Birches, and it is a wood especially suited for turnery work. In colour it is a uniform creamy-white with no distinctive figuring, and is straight grained, with a fine and uniform texture. Average samples weigh between 35 and 40 lbs. to the cubic foot (lighter than the two preceding timbers). For more detailed particulars regarding this wood see Cox and also McElhanney.

Macroscopic identification features of White Birch

Conform with the characteristics of the genus as described above.

Black Bean

This is an extremely hard wood that becomes dry and brittle with age, being refractory under seasoning treatments and very liable to warping and collapse. It was formerly well

known on the world's timber markets, and a steady demand still exists for the wood, but as the tree producing it (*Castanospermum australe*) has only a very limited distribution in certain parts of Australia, the available supplies are falling off yearly. Black Bean is a botanical hardwood, weighing anything between 45 and 50 lbs. to the cubic foot when properly air dry, has straight or shallowly interlocked grain, and a somewhat coarse texture. The sapwood and the heartwood are sharply distinct, the latter ranging from chocolate-brown to almost black, with a prominent figuring. It is a difficult timber to work, whether by hand or by machine, though it both carves and turns with satisfactory results. The timber is naturally resistant to the attack of wood-rotting fungi and also to termites, but the sapwood is said to be liable to powder-post beetle attack. It may be used for internal fittings, high-class furniture, and work of a similar nature. The authors Cox and Swain should be consulted for fuller details of the wood.

Macroscopic identification features of Black Bean

Diffuse porous in structure. Vessels medium to large in size; solitary, and in radial rows, the rows being more common; whitish deposits common; simple perforations. Vessel lines distinct to the naked eye. Rays visible to the naked eye on transverse section and reasonably distinct on radial surfaces. Wood parenchyma light in colour; aliform, and tendency to confluent. Ripple marks present and usually distinct to the naked eye. Pith flecks not present.

Blackbutt

This is a member of the great Australian family of Eucalypts, being the timber of *Eucalyptus pilularis* of the Myrtaceæ family, New South Wales and the southern coastal regions of Queensland being the natural home of the tree producing the timber. It is a hardwood with an average weight of between 40 and 50 lbs. to the cubic foot, the grain being rather interlocked and the texture moderately coarse but uniform. In colour the wood may be light brown to brownish, with pinkish markings. The wood both looks and feels rather greasy, but it is a prominent member of the Eucalyptus family that is of rather more

than only local importance. The tree providing the wood has an additional economic use in that it yields an abundant supply of oil. In general the wood conforms to the other, better-known Eucalypts (such as Jarrah) in regard to its working, seasoning, etc., qualities.

Blackwood, Australian

The tree providing this timber—the *Acacia melanoxylon* of the Leguminosæ—reaches its maximum development in Tasmania, though it is also to be found in South Australia, Victoria, and on the table-lands of New South Wales. It is a hardwood timber having an average air dry weight of between 40 and 50 lbs. to the cubic foot. The grain is variable, being either straight, interlocked or wavy, but the texture is invariably fine and even. In colour the wood may range from reddish-brown to a very dark brown, with a figuring of darker streaks, and it has a lustrous surface. It is a naturally durable timber of more than local importance, for the demand for the wood is a steady one, although in normal times no undue difficulties arise in making supplies available. Typical uses for the timber include furniture-making, interior fittings, high-class joinery, gun stocks, and cooperage. The timber sometimes seen on the world markets and described as African Blackwood comes from a different species—the *Dalbergia melanoxylon*—and is thus related to the Rosewoods.

Bloodwood, Red

The wood is the product of a common Australian tree—*Eucalyptus corymbosa* of the Myrtaceæ—but the timber is not yet well known on the general market. It is a naturally durable timber when exposed to the weather, and is especially resistant to fire hazards, but the usefulness of the wood is somewhat decreased by the numerous gum veins to be found in it. Red Bloodwood is a hardwood, weighing about 62 to 65 lbs., to the cubic foot, and has an interlocked grain and a medium coarse texture. It is a uniform red in colouring with no distinctive figuring on flat-sawn surfaces, though quarter-sawn faces may have a slight stripe figure. Typical uses for the timber include railway sleepers, fencing posts, flooring, telegraph and telephone poles, etc. There is no reason to anticipate that

the wood will ever come into popular demand, other than as a local structural or sleeper timber, but various studies of Bloodwood have been made by Australian writers.

Boxwood

This is the timber of *Buxus sempervirens* of the family Euphorbiaceæ, and is frequently offered for sale under the name of Turkish Boxwood. Although many timbers are sold under the description of "boxwood" this is one of the few that really belongs to the true Boxwood family. It is the product of a tree common to various parts of Europe and Asia Minor, and large quantities of the wood reach the world markets, though it is only available in small sizes. It is not naturally resistant to the attacks of wood-rotting fungi, but it is not of the type of timbers given a preservative treatment in view of the uses to which it is put. Under seasoning treatments it needs careful handling as fine cracks or splits may develop during that process. Boxwood is rather difficult to work with hand tools, and needs to be pre-bored before nailing, screwing, etc., as it has a very marked tendency to split, but its close grain makes it an invaluable timber for wood engraving. Other typical uses for Boxwood include the making of mathematical rules and scales, inlaying, fine cabinet work, musical instruments, turnery, etc. The timber is light yellow in colour, with a fine and uniform texture and a straight grain, and may weigh between 52 and 62 lbs. to the cubic foot. For a full study of the timber see Chalk and Rendle; Winn. A larger species than that considered here, but having much the same characteristics, is the *Buxus balearica*, known as the Minorca or Balearic Boxwood.

Macroscopic identification features of Boxwood

Diffuse porous in structure. Growth rings usually reasonably distinct to the naked eye; boundaries delimited by bands of denser late wood, but little difference between early and late wood. Vessels very small; just visible under a hand lens; uniformly distributed; solitary; no tyloses but vessels often contain yellowish gum deposits; scalariform perforation plates. Vessel lines not visible to the naked eye and barely visible under a hand lens. Rays heterogeneous; very fine; not visible

to the naked eye and not visible under a hand lens, but parenchyma both of metatracheal and paratracheal types present; no crystal deposits in wood parenchyma cells. Ripple marks not present. Pith flecks not present.

Boxwood, Kamassi

This, sometimes alternatively described as Kynsna Boxwood, is a hardwood timber that, whilst not a member of the true Boxwood family, provides a good substitute for that wood for some purposes. The timber is the product of a South African tree—*Gonioma kamassi*—that grows to a height of about 30 feet. It seasons slowly but well, though serious cracking may develop if the drying process is unduly hastened. Kamassi Boxwood works well in most hand or machine operations and can be brought to a good surface; it always turns well and reacts satisfactorily to most types of finishing treatment. The timber ranks as about the most important to be exported from South Africa and normally reaches the United Kingdom markets in the form of small logs or billets. It has a light yellow or brown colouring, with no figuring, straight grain, and a very fine and uniform texture. When air dry average specimens weigh about 58 lbs. to the cubic foot. If a green tinge is visible in the timber it is an indication that the wood may be decayed, or that incipient decay is certainly present. For a study of the wood at greater detail see Chalk and Rendle; Cox.

Macroscopic identification features of Kamassi Boxwood

Diffuse porous. Growth rings reasonably distinct to the naked eye. Vessels evenly distributed; not visible to the naked eye but visible under a hand lens; solitary; simple perforations; solid deposits and tyloses may be present. Rays heterogeneous; smaller rays very fine and hardly visible to the eye under a hand lens; larger rays just visible to the naked eye and distinct under a lens; very numerous. Wood parenchyma not visible to the naked eye, but normally just visible under a hand lens; moderately abundant; in fine, close-spaced irregular lines. Ripple marks not present. Pith flecks not present.

Boxwood, West Indian

This is sometimes sold as Maracaibo Boxwood, Venezuelan Boxwood or Zapetero, and is the product of a tree—*Casearia praecox*—of tropical America, more especially from the Maracaibo district of Venezuela. It is a hardwood timber with an average weight on a par with that of the other commercial boxwoods (56 to 58 lbs. to the cubic foot), with a straight grain and a very fine and uniform texture. In colour the wood may range to clear yellow from almost colourless, being uniform in any given specimen, but it has no distinctive taste or smell. The timber is normally transhipped from Curaçao in the form of logs that rarely exceed 12 feet in length. West Indian Boxwood is very much subject to chemical stain, and may split or check badly during seasoning processes. It is not naturally resistant to wood-rotting fungal infection, but works well in all operations, carves and turns excellently, but is apt to split rather more easily than is true Boxwood. Typical uses for the wood include turnery, musical instruments, rulers, wood carving, and so on. For a really detailed study of the timber see Record and Mell.

Bulletwood

This timber, or Beefwood as it is sometimes called, is provided by different species of *Mimusops* of the Sapotaceæ family; it should not be confused with the wood of *Casuarina equisetifolia* which has been dealt with in a previous entry. The heartwood is a rich reddish-brown in colour, sometimes with a darker figuring, but having a non-lustrous surface and possessing no characteristic taste or smell; the grain is shallowly interlocked or irregular, the texture fine and even and the average weight for air dry stock about 65 lbs. to the cubic foot. The timber enjoys a considerable reputation all over the world both for its strength and durability. Bulletwood is not an easy timber to work by hand, but unless really deeply interlocked grain is present machining causes little difficulty, and the wood may be brought to an excellent surface. It takes nails and screws satisfactorily, glue adheres well, and it is capable of taking a high polish. A steady demand exists for the wood, but in normal times supplies prove sufficient to meet the demand. Structural work, boat building, furniture

and cabinet making, tool handles, wheel spokes and railway sleepers are amongst the uses to which the timber may be put. For further information regarding Bulletwood, its anatomical structure, mechanical properties, etc., see the detailed study of the wood made by Pearson and Brown.

Macroscopic identification features of Bulletwood

Diffuse porous structure. Growth rings absent or scarcely visible under a lens; boundaries marked by zones that have no vessels. Vessels very small, but the largest are to be seen under a lens; open, or filled with tyloses; dark coloured gum deposits may be present; mostly in radial rows, but some solitary vessels; simple perforations. Vessel lines very fine, and not distinct to the naked eye. Rays heterogeneous, not distinct to the naked eye; visible under a hand lens on transverse section; sparse paratracheal parenchyma; metatracheal parenchyma in fine, wavy bands; abundant crystal and starch deposits common in the wood parenchyma of the sapwood. Ripple marks not present. Pith flecks not present.

Butternut

This wood frequently reaches the market under the description of White Walnut, and is the product of *Juglans cinera*. It is a North American timber that is a member of the true Walnut family and genus, but it is generally regarded as being inferior, as a timber, to the Black Walnut of the same continent. Like all the Walnuts, it has an economic importance for its fruits as well as its timbers. It is not a good wood to handle under seasoning treatments, and a high degree of care is necessary to avoid an undue rate of degrade. Butternut is not a difficult timber to work under most hand or machine operations, it has no considerable effect as regards the dulling of tools, and it may be used for all the normal Walnut purposes. The timber is brownish in colour, but has a lighter tint than the other commercial Walnuts, being at times almost greyish. The grain is normally straight, but the texture is somewhat coarse. Weight varies between 35 and 45 lbs. to the cubic foot. See other species of Walnut below, and for particular reference to Butternut see works by McElhanney and by Hale.

Macroscopic identification features of Butternut

These closely resemble those of the English species of Walnut. See remarks under this latter timber.

Butternut, Rose

The tree producing this timber—*Blepharicarya involucrigera*—exists in commercial availability in northern Queensland, but the wood is not well known on the timber markets. It is a hardwood timber with an average weight of 38 to 45 lbs. to the cubic foot, with straight or interlocked grain, and a medium coarse but uniform texture. The colour is light pinkish-brown or darker, but there is no distinctive figuring with plain-sawn faces. It is a strong and tough—but reasonably soft—wood, and is said to be expensive to convert as large baulks normally have a black and useless heart. Rose Butternut is not a naturally durable timber, and takes a considerable time to season, but once the process is completed it is very stable and does not “work” to any appreciable extent. The timber works well under hand or machine operations, with little dulling of tool edges, and will take most of the normal types of finishing treatment, though it does not fume well. It may be used for ordinary domestic furniture, cabinet making, certain types of cooperage, and similar purposes. See books by Baker and by Swain.

Buttonwood

This timber is the North American equivalent to the Sycamore or Plane of Europe (see below), and is the product of the largest deciduous tree (*Platanus occidentalis* of the Plantanaceæ) of the United States of America; the tree is of rather rapid growth habit. When exposed to the weather or in contact with the soil the timber is not particularly durable, but it is a hard, tough and strong wood that finds a variety of uses. Although not a refractory timber under seasoning treatments it has a rather marked tendency to warp, more especially in thin stock. It is a somewhat difficult timber to work, whether by hand or by machine, but it finishes with a good surface and responds satisfactorily to decorative treatments such as staining, etc. Buttonwood is light brown or yellowish in colour, with a very irregular grain but a fine and

uniform texture; its average weight is between 30 and 40 lbs. to the cubic foot. The timber may occasionally be marketed as American Plane.

Macroscopic identification features of Buttonwood

The timber is a close botanical relative of the Plane, and its identification features are very similar. See entry on Plane below.

Camphor, East Indian

This little known hardwood timber is the product of a tree (*Ocotea usambarensis* of the Lauraceæ) of Kenya Colony, and is closely related botanically to several timbers of purely local importance. Average specimens weigh in the region of 36 lbs. to the cubic foot, the texture is moderately fine and uniform, and the grain normally interlocked. In colour it is dark brown, and quarter-sawn stock may show a striped figure, whilst the wood has a very distinctive smell of camphor. It is a naturally durable timber when exposed to the weather, but it is a cabinet wood rather than a structural or general utility timber, being used for furniture making, panelling, interior fittings, high-class joinery and work of a similar nature. Under seasoning treatments the timber may prove to be somewhat refractory, and the degree of degrade may be on the high side. It is not an easy timber to work, whether by hand or by machine, but good results may be obtained if tools are kept clean and keen.

Carrobean

This is a commercially important timber in Australia, and is a hardwood provided by various species of *Sloanea*. Different varieties, such as Grey and Blush are recognized, but apart from differences in hue, there is little to distinguish the species. Average air dry timbers may weigh between 35 and 40 lbs. to the cubic foot, the grain is usually shallowly interlocked but the texture fine and even. The colour is variable but normally a light reddish-brown, whilst quarter-sawn stock shows a silver grain figuring. Under tools the wood works well, but its rate of durability is not good and it is not especially noteworthy for its seasoning qualities. There is very little likelihood of the wood achieving any importance on the

world market, which is already sufficiently supplied with hardwoods of a superior nature and more ready availability.

Cedar

The tree producing this timber—*Abies cedrus*—is to be found both in America and in Asia. Botanically the timber is a softwood and it has an average weight of between 23 and 33 lbs. to the cubic foot. The grain is normally straight and the texture medium fine and uniform. In colour the heartwood is lightish brown, with a marking of darker streaks or lines, and when freshly sawn the wood has rather a pleasant smell. Having low shrinkage factors the timber seasons without undue distortion and consequently with very little degrade. Cedar handles well in all hand and machine operations with only a negligible dulling effect on tools, and it is useful for such items as pattern-making, boat building, cheap furniture, etc. It is not a naturally durable timber when exposed to unfavourable conditions, and is one that is difficult to impregnate with wood preservatives, though in common with all the other softwoods it is immune to the attack of the powder-post group of beetles.

Cedar, African Pencil

In any but the smallest sizes, timber of this species shows a considerable amount of surface checking, shaking and end-splitting during seasoning treatments, but as the importance of the wood rests primarily on its use in the manufacture of pencils, the timber is normally imported into this country in the form of pencil slats of $2\frac{1}{4}$ in. by $\frac{1}{2}$ in. end-section. Pencil Cedar may be used for the lining of caskets, clothes chests, and similar work where the fragrance is an asset, provided that it can be obtained in sufficiently large dimensions. The timber is an exceedingly easy one to work, but it readily splits and needs pre-boring for such operations as nailing and screwing. Glue adheres well and the wood will respond satisfactorily to most of the normal types of finishing treatment. The timber is provided by the *Juniperus procera*, and is a botanical softwood. Its weight may range between 30 and 40 lbs. to the cubic foot, the grain is straight, but the texture coarse and uneven. In colour the wood is reddish-brown, and it has neither

figuring nor distinctive taste, but the typical smell of the Cedar woods is present. Its durability factors are low, but this is of no importance in view of the uses to which it is put.

Cedar, Barbados

Of local importance only, this softwood timber conforms closely to the other *Juniperus* species as regards its various qualities. Under seasoning treatments the wood behaves reasonably well and degrade figures are not too high, though there may sometimes be a tendency to warping, especially in thin stock. Knots may cause a certain amount of trouble in working the wood, but on the whole it is not refractory and may be brought to a good surface, but it is of the class of timbers needing pre-boring for certain operations. The average weight of the timber varies between 25 and 35 lbs. to the cubic foot, the grain is normally straight, and the texture fine and uniform. In colour the wood is light red or brownish, with no distinctive figuring, but with a mild and characteristic pleasant smell. The tree producing the timber is the *Juniperus barbabensis*. Barbados Cedar may be summarized as a non-ornamental cabinet wood of local importance only.

Cedar, Eastern White

Although not ranked as amongst the most important timbers on the world markets, Eastern White Cedar is of considerably more than local importance. The shrinkage factors of the wood are low, and in consequence it seasons with little distortion. It is rated as naturally resistant to the attacks of wood-rotting fungi when used in positions favourable to its attack, and, like all the softwoods, it is immune from powder-post beetle attack. On the North American continent the wood is commonly used for such purposes as roofing shingles, boat and canoe building, fencing, telegraph poles, garden furniture, and so on. The working qualities of the timber are good, both under hand and machine operations. The wood comes from the *Thuja occidentalis*, and may reach the market under the alternative names of Eastern Cedar or Northern White Cedar. The average weight is between 25 and 30 lbs. to the cubic foot, with the grain straight, and the texture fine and uniform. In colour the wood is lightish yellow.

Cedar, Honduras

This is the product of *Cedrela mexicana*, and may be sold under the names of Cigar-box Cedar, Spanish Cedar, Mexican Cedar, West Indian Cedar or Central American Cedar. It is a hardwood timber, extremely variable in weight, specimens weighing anything between 28 to 45 lbs. to the cubic foot; the texture is also variable, but normally it is straight grained. The heartwood of the species may range from pink, through shades of red, to red-brown in colour, but is uniform in any one specimen; the wood has the typical smell associated with the Cedars. Honduras Cedar is a durable timber of tropical America that, when available, is popular on any market in the world. It is an extremely easy timber to handle, either in hand or machine operations, but has a tendency to split and needs pre-boring for nails, screws, etc., and it is also very liable to chip out whilst it is being mortised; glue adheres well, and the timber slices satisfactorily for veneers, but it is not a really suitable wood for turnery purposes. Once fully seasoned Honduras Cedar is stable, and shows little sign of "working". For literature regarding the wood see Cox, and also Record and Mell.

Macroscopic identification features of Honduras Cedar

Normally a diffuse porous structure, but some specimens may show a tendency towards a ring porous structure; growth rings of the diffuse porous specimens are marked by lines of terminal parenchyma. Vessels not very numerous; variable in size; mostly open; tyloses to be seen very infrequently; dark gum deposits are common; simple perforations. Vessel lines are quite distinct and show up well against the lighter background. Rays heterogeneous; distinct on radial surfaces and visible on tangential surfaces and transverse sections; calcium oxalate deposits and gum deposits are usually to be found in the ray parenchyma cells. Distinct terminal parenchyma in narrow bands or lines to mark the growth rings; inconspicuous paratracheal parenchyma round the vessels; crystal deposits or gum deposits often to be found in wood parenchyma cells. Ripple marks not present in this species. Pith flecks not present. The wood has the distinctive taste and smell associated with the Cedar timbers.

Cedar, Western Red

For a softwood this timber shows a very high degree of resistance to the attacks of wood-rotting fungi, and the wood is classed as difficult to impregnate with preservatives, even by pressure processes. Incising, carried out by passing the timber under a series of spiked rollers, is frequently resorted to so as to ensure a greater degree of penetration of the preservative. Western Red Cedar contains an agent that causes it to develop a black stain when in contact with iron, and corrosion of iron bolts, screws and fastenings fitted into it will eventually occur. The tree providing the timber is the *Thuja plicata*, and the wood has an average weight of between 20 and 30 lbs. to the cubic foot; it is straight grained, but the texture is somewhat coarse. In colour the narrow sapwood is whitish, whilst the heartwood may range from pinkish-red to deep brown: the wood has no characteristic taste or smell. For further details of this wood see works by Cox, Hale, and also McElhanney. It should be noted that the wood may also reach the market under the title of Pacific Red Cedar, Giant Cedar, Red Cedar (a name commonly applied to many other timbers), Western Cedar, or British Columbian Cedar, though in the American market, in particular, it is best known by the title given above.

Cedar, West Indian

This is sometimes known as Bastard Barbados Cedar, and is the product of *Cedrela odorata*. This is a typical Cedar wood, being soft and light (though botanically a hardwood) and having the usual fragrant smell. It is used locally for the making of roofing shingles and canoes, but it is also suitable for the manufacture of cigar-boxes and pencils, and for the lining of chests and caskets. The wood is not important from the general consumer's point of view. It is a very easy timber to work, but it is brittle and needs pre-boring before nailing or screwing. In weight the average is between 35 and 40 lbs. to the cubic foot; the grain may be either straight or irregular, and the texture moderately coarse and uneven. The heartwood is lightish red in colour, with the sapwood normally sharply differentiated from it. This timber is not to be confused with the Honduras Cedar, which sometimes reaches the market under the description of West Indian Cedar.

Macroscopic identification features of West Indian Cedar

Similar to those of Honduras Cedar above, as it belongs to the same genus.

Cedar, Yellow

Yellow Cedar, Alaska Cypress or Alaska Cedar, as it is variously called, is a softwood timber, the product of *Chaemycyparis nootkatensis*. Its average weight varies between 25 and 35 lbs. to the cubic foot, the grain is straight, and the texture fine and uniform. The timber is yellowish in colour, and has a markedly strong odour when freshly felled. Yellow Cedar is already known on the world markets, and supplies are readily available to meet the future demands. The tree producing the wood is common in North America, reaching its best development in Alaska, with a geographical range as far south as Oregon. It is, for a softwood, more than normally durable, and is difficult to impregnate with wood preservatives; it also shows a marked resistance to the action of acids, hence it is very suitable for use for laboratory table tops and similar purposes. The shrinkage factors of the wood are low and it seasons with little difficulty, being very stable once the seasoning process has been completed. It is exceptionally easy to work in all hand or machine operations, turns and carves well, takes nails, screws, glue, and the normal types of finishing treatment satisfactorily. For a further study of the wood in detail see McElhanney.

Cherry

Economically the Cherry is not regarded as a timber tree though the wood has certain minor uses and it is not uncommon on the market. The timber has a rather high oil content and will not always polish satisfactorily, though it responds well to most of the other kinds of finishing treatment. Working qualities are good, and it carves and turns well. There is, however, only a very limited demand for the wood. Typical uses for Cherry include carving, turnery, mouldings, picture frames, inlaying, small fancy articles, tobacco pipes, walking sticks, and similar items. The wood is provided by the *Prunus avium*, and weighs between 38 and 45 lbs. to the cubic foot. The grain is straight, the texture moderately fine and uniform,

and the heartwood pinkish to light brown in colour. There is no distinctive taste or smell with the timber. Closely related species include the Austrian Cherry (*Prunus mahaleb*) and Black Cherry (see below), whilst the tree is related botanically to both the Apple and Pear. For details of the anatomical structure of Cherry see the study by Chalk and Rendle.

Macroscopic identification features of Cherry

Diffuse porous. Growth rings usually distinct to the naked eye; boundaries marked by zones of early wood showing numerous vessels. Vessels small; not always visible to the naked eye, but usually distinct under a hand lens; solitary, or in radial groups; gum deposits abundant. Vessel lines may be distinct by virtue of the gum deposits. Rays homogeneous; not always clearly visible to the naked eye; moderately broad; rather conspicuous on radial surface. Wood parenchyma is not visible to the naked eye, or even under a hand lens; occasional gum ducts present. Ripple marks not present. Pith flecks may be present.

Cherry, Black

This is the product of *Prunus serotina*, and may be regarded as the North American equivalent to the common European Cherry, though it is of greater economic importance as a timber than the European wood. The timber has low shrinkage factors and seasons easily, and once that process has been completed the wood is very stable and shows a comparative freedom from movement. The durability of the wood is about on a par with that of its European counterpart, but it is normally available in larger sizes. With regard to its working qualities, it is rather harder to work by hand than is common Cherry, but its dulling effect on tools is not very appreciable. It responds well to the kinds of finishing treatment usually given to a non-ornamental cabinet wood. Average specimens of Black Cherry weigh about the same as those of the species considered above, the grain is straight, and the texture fine and uniform. The heartwood is a warm reddish-brown in colour. For a study of the wood in greater detail see books by Hale and also by McElhanney.

Macroscopic identification features of Black Cherry

See structure as described under "Cherry" above.

Chestnut

This timber—*Castanea sativa*—is a hardwood that closely resembles Oak in its general appearance, but quarter-sawn material does not show the prominent ray figuring, or so-called silver grain, that is so characteristic of the true Oaks. The tree producing the timber is common to all parts of the north temperate zone, being of long life habit, and supplies are probably more than adequate to meet normal demands. The timber is easy to work, whether by hand or by machine, is too coarse textured to turn satisfactorily, but it is suitable for broad carving. It is an easy timber to split, and is in considerable demand for conversion into split pale fencing. Other typical uses for the timber include the making of garden and church furniture, gates, panelling, telegraph and telephone poles, domestic furniture (when it is often stained to represent mahogany), casks, etc. The heartwood of the timber may range from a light to a dark brown in colour, the grain is normally straight, but the texture coarse and rather uneven. Average air dry specimens should weigh round the 38 lbs. to the cubic foot mark. See also the descriptions given by Chalk and Rendle; Howard; Winn.

Macroscopic identification features of Chestnut

The growth rings are quite distinct to the naked eye and are marked by the large vessels of the early wood. The vessels are oval in shape, mostly solitary, and are arranged radially; open. Vessel lines are distinct to the naked eye. Rays are very fine and numerous. Ripple marks and pith flecks are not present in the genus. Although closely resembling Oak (see below) the two timbers can always be differentiated by their difference in ray parenchyma, as the broad rays are not to be found in the genus under consideration.

Chestnut, American

American Chestnut, also known as Sweet Chestnut, is a close botanical relative of the preceding timber, and is the product of *Castanea dentata*. It is the North American equivalent

to our Chestnut, and is an important timber tree, though supplies of the wood are diminishing rapidly owing to the depredations of the "Sweet Chestnut Borer". Rich in tannin, the timber seasons easily and does not "work" unduly once the drying process is completed. The timber is moderately durable in exposed positions, and durable for all purposes under cover. American Chestnut works easily in all operations, but being brittle it is apt to split and needs to be pre-bored before screwing; it reacts satisfactorily to the normal types of finishing treatment. The timber may be used for the same purposes as European Chestnut. It is rather heavier than the latter timber, being between 36 and 46 lbs. to the cubic foot, the sapwood is lightish in colour, and the heartwood pale brown with a distinctive figuring. Straight grained, the timber shows a somewhat coarse and uneven texture. Hale and McElhanney have both given studies of the wood.

Macroscopic identification features of American Chestnut

Being a member of the same genus as the English Chestnut, the macroscopic identification features are almost identical.

Chickrassy

This may reach a limited market under the name of Yimna or Chittagong Wood. It is a hardwood timber, the product of *Chukrassia tubularis*, with an average weight of 35 to 45 lbs. to the cubic foot, with straight grain and a moderately fine and uniform texture. The heartwood is golden-mahogany or reddish-brown in colour, with a distinctive figuring. In India the wood is often described as White Cedar, but it is unlikely that the very small quantities of the timber that reach the world markets will do so under that description. Chickrassy is a rather ornamental cabinet wood, but it is only moderately durable for use in exposed positions, and the general usefulness of the timber is marred by the fact that compression failures are not an uncommon feature of it. The wood works with moderate ease in all operations, and peels well for veneers. Satisfactory results may be achieved by carving, and the wood responds well to normal finishing treatments. For a detailed study of the structure, mechanical properties, etc., of the timber, see the *Commercial Timbers of India* written by Pearson and Brown.

Coachwood

The timber of *Ceratopetalum apetalum* is a hardwood, having an average weight of some 40—45 lbs. to the cubic foot, with a light brown to pinkish-brown heartwood (uniform in any one specimen), straight grain, and a fine and uniform texture. Coachwood is an Australian timber coming from a tree to be found in various districts of New South Wales and Queensland, but although it is available on the world markets from time to time it is not likely to challenge the supremacy of better known timbers of the same class. It is not a very difficult wood to work, turns well, and could be summarized as an extremely useful decorative cabinet timber. It is a durable wood for use in positions protected against the weather, but is not satisfactory in exposed positions. More use might possibly be made of the timber in this country for the manufacture of veneers. For further literature on Coachwood, see Baker; Swain.

Cocobolo

Cocobolo is closely related to the Rosewoods and is of tropical American origin. Only small quantities of the timber reach the world markets, however, and that is almost entirely taken by the cutlery trade for the making of knife handles, and similar items. The wood is naturally resistant to decay but needs careful attention during seasoning processes if the rate of degrade is to be kept within reasonable bounds. It works reasonably well in all hand or machine operations, and is a good timber for turnery purposes. It is a hardwood, the product of *Dalbergia retusa*, the heartwood being a very dark reddish-brown in colour, with a figuring of darker irregular markings; it has a faintly fragrant smell. The grain is usually straight, but may be wavy, whilst the texture is medium fine and uniform. Average weight is between 50 and 60 lbs. to the cubic foot. For a full study of the timber, including its anatomical structure and mechanical properties, see Record and Mell.

Macroscopic identification features of Cocobolo

Being of the same genus as the Brazilian Rosewood its identification features are very similar. See "Rosewood, Brazilian".

Cocuswood

This timber is the product of *Brya ebenus*, and has the alternative names of Jamaica Ebony or West Indian Ebony. It is a tropical American hardwood timber coming from a tree of low growth habit, and is available only in the form of small logs. The heartwood is blackish in colour, and is the only part of the tree that is of any commercial use. Cocuswood causes little trouble in seasoning, does not readily warp or check, and is classified as durable when exposed to the weather or used in contact with the soil. It is somewhat brittle and should be pre-bored before nailing, screwing, etc., but the wood turns and finishes satisfactorily. Typical uses include inlaying, brush backs, turnery, parquet, and musical instruments. It is very heavy (average 75 lbs. to the cubic foot) and has a fine and uniform texture, with the grain either straight or wavy. Although it is not a well known timber in the strict sense of the word, supplies of Cocuswood are normally obtainable on the United Kingdom markets. See literature by Howard; Record and Mell; Stone.

Macroscopic identification features of Cocuswood

Diffuse porous. Growth rings distinct to the naked eye, boundaries being marked by an abundance of parenchyma. Vessels very small; in short radial groups; open in the sapwood; tyloses present in the heartwood; dark gum deposits present in the heartwood. Vessel lines fine, and not always readily distinguishable. Rays barely visible to the naked eye on radial surfaces, but invisible to the naked eye on tangential surface; and transverse sections. Wood parenchyma abundant; faintly visible to the naked eye in the sapwood; not visible in the heartwood; in fine concentric lines. Ripple marks present; not normally visible to the naked eye, but visible under a hand lens.

Cottonwood

Cottonwood is a North American species of Poplar—*Populus deltoides*—that flourishes in the upper parts of the Mississippi and Missouri valleys. Normally the tree has a not inconsiderable girth, and consequently very wide boards are readily obtainable. Its properties are akin to those of Poplar,

that is to say, it works easily in all hand or machine operations, carves and turns well, and takes stain, paint, and other finishing agents satisfactorily. Although not to be included with the really refractory timbers, it may cause a certain degree of difficulty in seasoning, showing a tendency to warp or twist. It is only rated as moderately durable, and is rather difficult to impregnate with wood preservatives. Cottonwood is lightish in colour, with no characteristic taste or smell, has a fine and uniform texture, and is normally straight grained. It is not particularly heavy, averaging 25 to 35 lbs. to the cubic foot. See literature by McElhanney.

Macroscopic identification features of Cottonwood

See the remarks given under the description of Poplar below. These details are also applicable to Cottonwood, as both timbers are of the same genus.

Crabwood

Central and South America supply the bulk of the world's supply of this wood. In the timber trade Crabwood is qualified as either "red" or "white" according to the predominating hue, but there is no botanical or other essential difference between them. The wood may also reach the market under the titles of British Guiana Mahogany, Brazilian Mahogany, Andiroba or Demerara Mahogany. The wood is somewhat inclined to warp and split during seasoning, and is not resistant to insect attack, though it is included in the timbers naturally resistant to the depredations of wood-rotting fungi. It is the product of *Carapa guianensis*, and though the heartwood may have a reddish or a lightish cast, it is normally a uniform darkish red-brown in colour. Weight may be between 35 and 45 lbs. to the cubic foot, the texture coarse but even, and the grain either straight or interlocked. Typical uses for Crabwood include the making of veneers, furniture, roofing shingles, and interior fittings of all descriptions, though it also has a certain claim to be regarded as a structural timber. Further details of the wood are included in works by Cox; Howard; Record and Mell.

Macroscopic identification features of Crabwood

Diffuse porous. Growth rings usually distinct to the naked eye; boundaries shown by fine lines of terminal parenchyma. Vessels numerous, solitary, and in radial groups; open; dark gum deposits common. Vessel lines coarse; distinct to the naked eye. Rays heterogeneous; very fine; usually visible to the naked eye on transverse section and tangential surface; distinct and conspicuous on radial surface. Wood parenchyma indistinct; terminal, and in concentric bands. No ripple marks. Gum ducts may be present.

Deodar

This is one of the most important Indian softwoods and is probably second to Teak as the most important native timber, but its uses are limited because of its pungent smell. It is said to be a durable timber when used in positions not protected against the weather or if in contact with the soil, but, like the majority of softwoods, it is not resistant to termite attack although it is resistant to powder-post beetle infestation. Deodar works well in most hand or machine processes, but it may be found rather difficult to glue or polish owing to the high oil content. In addition to normal joinery purposes it also makes a good structural timber. It is straight grained, has a moderately fine and uniform texture, and is lightish in colour when first cut, though it darkens after exposure to the atmosphere. It has a distinctive unpleasant smell. Deodar, which is the timber of *Cedrus deodara*, may be sold under the title of Indian Cedar or Himalayan Cedar. Ample supplies of the wood exist to meet present, and probable future, demands. See the literature by Pearson and Brown.

Macroscopic identification features of Deodar

Softwood. Growth rings distinct to the naked eye, boundaries marked by denser bands of late wood. Tracheids medium fine; in radial rows; change in size from early wood to late wood gradual. Wood parenchyma extremely scanty. Rays not distinct to the naked eye; commonly uniseriate. Normal resin canals missing, but traumatic canals, both longitudinal and transverse, are frequently present.

Ebony

The timber comes from trees to be found in Nigeria, India, Ceylon, Gold Coast, French Sudan, Gambia, the East Indies, etc., and is the timber of *Diospyros ebenum*, though other species of *Diospyros* may be included in consignments of the wood. The timber is one of the few that is exported at a price per long ton as opposed to the shipping ton of 42 cubic feet. It is a very heavy hardwood timber, averaging between 70 and 80 lbs. to the cubic foot, with a straight or slightly irregular grain and an extremely fine and uniform texture. In its colour the heartwood may range from dark brown to jet black, whilst occasionally a striped figure is to be seen on quarter-sawn stock. Ebony is a difficult timber to season, and may develop end splits or surface checks whilst drying. It is naturally resistant to wood-rotting fungi and is also immune to powder-post beetle attack on account of the small size of the vessels. It is extremely difficult to work, but can be brought to a good surface, and polishes and turns well. On account of the limited uses to which the wood is put it is reasonable to assume that supplies will always be sufficient to meet demands. Brush backs, piano keys, novelties, etc., are amongst the uses to which it may be put. Amongst others, see Pearson and Brown for a description of the timber. The wood sometimes described as Malabar Ebony is the *Diospyros malabarica*.

Macroscopic identification features of Ebony

Diffuse porous structure. Growth rings inconspicuous or absent. Vessels very small; not distinct to the naked eye; open, or partly filled with dark coloured gum deposits; solitary, and in short radial rows; simple perforations; tyloses not present. Vessel lines very fine; not visible to the naked eye. Rays heterogeneous; very fine; not visible to the naked eye but may be visible under a hand lens; crystals very numerous in the ray parenchyma cells. Abundant metatracheal parenchyma present in fine concentric lines, but this is not usually to be seen, even with a lens; sparse paratracheal type of parenchyma also present. Ripple marks not present. Pith flecks not present.

Elm, Common

The tree producing this timber (*Ulmus campestris* of the Ulmaceæ family) is a common one of the north temperate zone, and is usually felled for timber when it is between 60 and 100 feet in height; the tree may have a life of as long as 140 years. A considerable amount of the trunk is free of branches, and in consequence the lack of knots is most marked. The heartwood of the timber is a dull reddish brown in colour, and average specimens may weigh anything between 30 and 40 lbs. to the cubic foot. The texture of the timber is coarse and uneven, whilst the grain is normally deeply interlocked. Elm needs considerable care in seasoning as the amount of degrade from warp or shake may be high. The interlocked grain may cause some trouble in planing, but otherwise the timber is not difficult to work. The wood is tough and resilient, far from brittle, but is especially noted for its durability under water, and may be used for wagon making, coffins, agricultural implements, gymnasium equipment, pulley blocks, ship building, and so on. Studies of the timber have been made by Chalk and Rendle; Howard, and by Stone. Other species producing Elm include the *Ulmus montana* (the Wych or Mountain Elm) common in this country, and the American species dealt with in the next two entries. Dutch Elm and Indian Elm (*Ulmus major* and *Ulmus integrifolia*) also produce commercial timbers.

Macroscopic identification features of Elm

Ring porous structure. Growth rings distinct to the naked eye; boundaries indicated by large vessels of the early wood. Vessels of the early wood large and round in section, but of the late wood small and only distinct under a hand lens; in tangential lines; whitish vessel deposits may be present; tyloses may be present. Vessel lines distinct to the naked eye. Paratracheal type of wood parenchyma present clearly visible with the aid of a hand lens. Ripple marks not present.

Elm, Rock

Rock Elm, the timber of *Ulmus racemosa*, shows all the toughness and resilience associated with the species, and ranks as an important timber on the world markets. Its durability is

on a par with that of the other Elms, and it is described as being a very difficult timber to impregnate with wood preservatives. It is heavier than the European species (averaging out between 45 and 55 lbs. to the cubic foot), the grain may be either straight or interlocked, whilst the texture is moderately coarse but uniform. The sapwood and the heartwood are not sharply differentiated, the wood being a lightish-brown in colour with no characteristic taste, but a faint, almost imperceptible smell. It is sometimes known as Cork Elm. It is a more difficult timber to work than is common Elm, but surfaces satisfactorily, and successful results may be achieved under bending treatments; it responds to finishing agents in the same manner as does Common Elm. Rock Elm has high shrinkage factors, and is a somewhat refractory timber under seasoning processes, being subject to warping and checking. As a further guide to the timber see works by Chalk and Rendle; Hale; Howard; McElhanney.

Macroscopic identification features of Rock Elm

Similar to those of the common English Elm described above.

Elm, White

White Elm may also be given the titles of Soft Elm or Water Elm. It is the timber of *Ulmus americana*, and has an average weight of some 36 to 45 lbs. to the cubic foot, with the grain either straight or interlocked and a somewhat coarse texture; the heartwood is lightish-brown in colour. The shrinkage factors of this North American Elm are lower than those of Rock Elm or Common Elm, although some specimens may cause a not inconsiderable difficulty in surfacing owing to the interlocked nature of the grain. Ample supplies of the timber would seem to be available to meet normal demands, though the wood is more popular on the American than on the United Kingdom markets. Typical uses for White Elm include flooring, athletic goods, wheelwrights' work, cooperage, agricultural implements, boat building, chairs, ladders and bent-wood work. Studies of the wood are included in literature by Hale and by McElhanney.

Macroscopic identification features of White Elm

See detail as given under Common Elm.

Fir

Sometimes described as White Deal or Norway Spruce, this is one of the most important softwood timbers of the world. It is provided by the genus *Abies* of many varieties to be found both in the Old and New world, though certain species may be marketed under specific names. The most important species in Europe is the *Abies excelsa*. In colour the timber is very light, the grain is normally straight, and the texture rather coarse and not uniform. It is a valuable structural softwood and also finds use for certain parts of musical instruments, interior joinery, and specialized uses in ship-building. As the tree grows to a height often in excess of 120 feet, and with a girth of from 4 to 6 feet, timbers of very good dimensions are obtainable. Seasoning qualities are quite good, and the rate of degrade low. The working qualities are excellent, though there is a tendency to brittleness which makes pre-boring for nailing, screwing, etc., advisable; mortising must be carried out with care. Fir is not a naturally durable timber and needs preservative treatments if used externally. In weight the average may run between 28 to 33 lbs. The timber often described as Scotch Fir does not come from the *Abies* genus, and is described under the Pines below.

Fir, Douglas

United States. Product of trees growing in the northern and western United States. Douglas Fir is the most important timber of the North American continent, and one of the best known softwoods in the world. The timber comes from a tall tree—*Pseudotsuga taxifolia*—and a very high percentage of the wood is free from knots. Although shrinking considerably in drying there is little trouble with the timber as regards checking, twisting or cupping, and the freedom from shakes is very marked. The wood is durable under cover and reasonably durable in exposed positions, but to ensure adequate penetration the wood needs to be incised for preservative treatment by pressure processes; it is unaffected by powder-post beetle attack. Douglas Fir works well in all operations, and may be used for all the normal softwood purposes, including structural uses. The heartwood of the species may range from reddish-brown to a definite yellow

in colour, and a distinctive figuring is present in flat-sawn timbers. Average weight runs between 32 and 42 lbs. for the cubic foot of wood, the grain is straight or slightly wavy, and the texture rather uneven. Alternative names under which the timber may be sold include British Columbian Pine, Yellow Fir and Red Fir. Studies of the timber have been made by Cox; Hale; McElhanney; Sargent, and Stone, amongst others.

Greenheart

British Guiana is the only place in the world where this timber is exploited commercially, though it has a reasonably wide geographic range. Greenheart is the timber of *Nectandra rodnei*, a botanical hardwood of the Lauraceæ family, and is very heavy, average specimens of the wood weighing about 72 lbs. to the cubic foot. The grain is straight, the texture variable from fine to medium coarse but uniform, with the heartwood dark olive green in colour with a darker figuring; the sapwood and the heartwood are not always sharply differentiated. The timber is remarkably durable and is especially favoured for lock and dock gates, and in many famous canal systems of the world the gates are made exclusively of Greenheart. Although often free of knots, Greenheart is a difficult timber to work, turns poorly, needs pre-boring for certain operations as it is apt to split, and it will not hold nails satisfactorily. Seasoning checks and splits are defects likely to be found in the converted timber. For studies of the wood in greater detail see Cox; Howard; Record and Mell. Greenheart sometimes reaches the market under the qualifying title of Demerara Greenheart. Other so-called Greenhearts are the Queensland and West Indian varieties, provided by *Endiandra compressa* and *Colubrina reclinata* respectively.

Macroscopic identification features of Greenheart

Diffuse porous structure. The growth rings are usually absent, but if present are very indistinct. Vessels small, but distinct either to the naked eye or with the help of a hand lens of low magnification; oval in end-section; numerous; solitary, and in occasional radial pairs; gum deposits usually present. Vessel lines fine; inconspicuous only very rarely, and

are normally distinct to the naked eye. Rays fine; inconspicuous on radial surface; invisible or only barely visible on tangential surface. Vasicentric type of wood parenchyma present. Ripple marks not present.

Gum, Spotted

This is one of the best known Australian timbers to be found on the general market in any quantity. It is the timber of a tree (*Eucalyptus maculata*) of New South Wales and Queensland that may grow to a height of 150 feet, so timbers of good size are available. The wood is rather difficult to season, and collapse may occur under heat treatments. Spotted Gum is said to be moderately durable but to be very difficult to treat with wood preservatives; the sapwood is stated to be susceptible to powder-post beetle and termite attack. It is moderately easy to work, though it is difficult to nail, and it bends well after steam treatment. The heartwood is light to darkish-brown in colour, darkening after prolonged exposure to the atmosphere, whilst the wide sapwood is whitish in tint; the timber has a rather greasy appearance. Much of the available timber is taken up for ship-building work, sleepers and wagon making. For further details of the wood see studies by Baker and by Swain.

Macroscopic identification features of Spotted Gum

Diffuse porous in structure. Vessels few; medium to large in size; solitary, or in short radial rows, the rows being most common; tyloses common. Vessel lines distinct to the naked eye. Rays heterogeneous; conspicuous on transverse section; deposits in ray parenchyma cells common. Abundant wood parenchyma; paratracheal and diffuse in type; crystal deposits common in wood parenchyma. Ripple marks not present in the genus. Pith flecks not present.

Hawthorn

Hawthorn is most frequently encountered as a small shrub of the *Crataegus* species, but sometimes it develops into tree form, though even then it is slender and its height rarely exceeds 8 to 10 feet, though some species may, under very favourable conditions, reach to twice that height. The timber,

therefore, is not economically important, but it finds minor use for inlaying and the making of tool handles. Hawthorn is rather difficult to work by hand, but carves satisfactorily and responds well to the normal kinds of finishing agents. It is naturally durable for external use, and seasons easily, being stable once that operation has been concluded. The heartwood of the species is whitish in colour, or may have a yellowish tinge, but the timber has no characteristic taste or smell. Normally the grain is straight and the texture moderately fine and uniform, with average timbers weighing between 38 to 45 lbs. to the cubic foot.

Hazel

Economically the Hazel tree (*Corylus avellana*) is more important for its nuts than for its timber, hence the latter is not to be found on the market in any quantity, though it is sometimes to be found in the form of machine-cut or embossed carvings or mouldings, but it may also be used for tool handles and certain types of cooperage. It is a hardwood timber, straight grained, and with a fine and uniform texture. The sapwood and the heartwood are not well defined, the wood being whitish to light reddish-brown in colour, with no distinctive taste or smell. It is an easy timber to work in all processes, finishes with a smooth surface and the worked edges remain sharp; it is of the class of timbers that should be bored before such operations as nailing and screwing, and care is also needed in mortising and drilling as there is a tendency towards chipping out. Only a limited demand exists for the wood, and supplies should be more than adequate to fulfill orders for many years to come. The weight of the timber varies between 35 and 45 lbs. to the cubic foot. For details of the structure and microphotograph of transverse section see Chalk and Rendle. The American species, *Corylus americana*, does not grow to a good height as does the European variety.

Hemlock, Eastern

Eastern Hemlock is the softwood product of a tree (*Tsuga canadensis*) of parts of the eastern North American continent. The average weight of the timber when air dry is from 25 to 35 lbs. to the cubic foot, and it is a light yellow in colour with

a reddish tinge and a pronounced growth ring figuring; the grain is generally very irregular, but the texture fine and uniform. Under seasoning treatments the wood is very refractory and shows a marked tendency to warp and twist. It is not an easy timber to work, whether by hand or by machine processes, and under machine tools the irregular grain may be responsible for a considerable degree of "picking-up". The timber is not an important one from the viewpoint of the world markets, but finds local use for such purposes as packing cases, railway sleepers, structural work, and carcassing. For a more detailed description of the wood and its properties see McElhanney.

Hemlock, Western

This is closely related to the preceding timber, being the wood of *Tsuga heterophylla*. It is sometimes marketed under the alternative names of Grey Fir or British Columbian Hemlock. It is a straight grained, fine and uniformly textured softwood with an average weight of 24 to 35 lbs. to the cubic foot, and a pale brown heartwood with a distinctive growth ring figuring. The wood is well known to timber consumers, and normally ample supplies of it are available for export. Being a member of the true Pine family, the timber cannot be regarded as resistant to the attack of either termites or wood-rotting fungi, but it is immune to powder-post beetle infestation; the heartwood of the species is classified as difficult to impregnate with wood preservatives. The timber seasons slowly but works well (though it may chip out during mortising), and having a tendency to split it should be pre-bored before nailing, screwing, etc. Satisfactory results can be obtained with almost all the usual kinds of finishing treatment. See the literature by Hale; McElhanney; Sargent.

Hickory

Hickory is a strong and resilient timber that is the product of a hardwood tree common to the eastern United States of America, and one that is frequently mistaken for Ash, which it closely resembles. It is rather a difficult timber to work in most operations, but it bends well and may be used for such purposes as the making of tool handles, agricultural implements,

wagons, chairs, boats, athletic goods, vehicles, and so on. The wood is moderately durable in positions exposed to the weather, is tough and elastic, can be brought to a good surface, and reacts well to the normal types of finishing treatment. The timber customarily weighs between 45 and 55 lbs. to the cubic foot, is straight grained, and has a coarse and not uniform texture. The heartwood of the species is brown or reddish-brown in colour, with a whitish sapwood. The wood is provided by various species of *Caraya* of the Juglandaceæ and is therefore related to the true Walnuts. A timber of lesser commercial importance is the Shagbark Hickory (*Hicoria ovata*).

Holly

This wood is used only for items of minor importance such as inlaying, marquetry work, small fancy articles and turnery. It is a hardwood timber with a dull white or greyish coloured heartwood, and an average weight of between 45 and 55 lbs. to the cubic foot, an irregular grain, and a very fine and uniform texture. The slow-growing but long-lived trees producing the timber are common enough in the north temperate zone, but the wood is available only in small sizes. Holly is not a naturally durable wood when exposed to the weather, but is immune to powder-post beetle attack on account of the smallness of its vessel openings. Ample supplies of the wood—the product of *Ilex aquifolium*—exist to meet the very limited demand, but more use might possibly be made of the timber for such items as wood sculpture and carving for which its very close grain would seem to suit it, and it is also useful for fine cabinet work. Working qualities are satisfactory, as it surfaces well and takes a good polish. For details of the anatomical structure of the timber, and a microphotograph of its end-section, see Chalk and Rendle.

Macroscopic identification features of Holly

Diffuse porous in structure. Growth rings not distinct to the naked eye; boundaries marked by rather narrow lines of denser late wood. Vessels very small, but usually visible under a hand lens; in radial rows of varying length; scalariform perforation plates. Vessel lines indistinct to the naked eye,

but normally visible under a hand lens. Wood parenchyma not distinct to the naked eye and not distinct under a hand lens. The ground mass of the wood is composed of fibres showing a spiral type of thickening. Rays numerous; distinct to the naked eye on transverse section and radial surface; prominent on tangential surface. Ripple marks not present in the genus. Very occasional pith flecks may be found.

Holly, American

This timber, the North American equivalent to European Holly, is the product of *Ilex opaca*, a slow growing tree of medium growth habit that reaches its best development in coastal regions. It is not a naturally resistant timber to the attack of wood-rotting fungi, but it is immune to powder-post beetle attack. The timber weighs rather lighter than the European species (40 to 50 lbs. to the cubic foot), and is a reasonably easy one to work, both in hand and machine processes; it finishes well and responds satisfactorily to decorative treatments, but its uses are somewhat limited. It is sometimes sold in the form of thin panels for fretworkers' use, and may be marketed with other *Ilex* species under the general description of Holly with a geographical prefix. The heartwood of the species is whitish or light yellowish in colour, the texture is fine and uniform, and the grain either irregular or wavy.

Macroscopic identification features of American Holly

See description as given for the previous timber.

Hornbeam

The timber of *Carpinus betulus* is by no means a rare one on the world markets, though it is not always available in large sizes. It weighs between 47 and 55 lbs. to the cubic foot, with the grain either straight or interlocked, the texture fine and uniform, and is whitish or very light in colour. Hornbeam may be described as a moderately durable wood when exposed to the weather or if in contact with the soil, but in view of the uses to which it is put its durability is of minor importance. The working qualities of the wood vary according to the degree of interlocked grain present, but in general the timber may be said to be difficult to work with hand tools; it reacts satisfac-

torily to the normal types of decorative treatment given to a timber of this nature; its uses are confined to inlaying, marquetry, and the making of small novelties, whilst in some types of work the wood may be dyed black and used to simulate Ebony. See studies of the timber made by Chalk and Rendle, and by Stone. The American Hornbeam (*Carpinus americana*) is of lower growth habit and has less importance than the European variety.

Macroscopic identification features of Hornbeam

Diffuse porous in structure. Growth rings usually distinct to the naked eye, their wavy outline forming a good diagnostic feature. Vessels small, sometimes visible to the naked eye, but visible under a hand lens; uniform distribution; in short radial lines; usually simple, but occasionally scalariform perforations. Vessel lines barely visible to the naked eye. Rays of different sizes; aggregate rays prominent on the transverse section; smaller rays visible only with a lens; narrow layers of wood parenchyma present. Ripple marks not found in the species. Extremely rare pith flecks may be present.

Horse, Chestnut

Horse Chestnut is whitish or yellowish, tinged with pink, in colour, with the heartwood and sapwood not sharply defined, and the timber is very likely to be confused with that of Lime, Willow or Poplar. It is the timber of a common enough tree—the *Aesculus hippocastanum*—of rapid growth, but the wood is not normally available in large sizes and its economic importance is insignificant. Horse Chestnut is only moderately durable and is mainly used as a cabinet wood. It is an easy timber to work, and may be used for such minor items as inlaying and the making of small fancy articles. The grain of the timber is often crossed or wavy, but the texture is fine and uniform; average weight borders on 35 lbs. to the cubic foot. The present supplies of the wood are more than adequate to meet the present and probable future demands. Chalk and Rendle include a microphotograph of the end-section and details of the structure in their "British Hardwoods". Several *Aesculus* species exist on the American continent, but are of no importance as timber.

Macroscopic identification features of Horse Chestnut

Diffuse porous in structure. Growth rings normally quite distinct to the naked eye, with each boundary marked by a faint line of terminal parenchyma. Vessels very small; not visible to the naked eye but usually visible under a hand lens; usually solitary, but some in short radial groups. Vessel lines very fine, barely if at all visible to the naked eye. Rays fine and numerous; not always visible to the naked eye but normally distinct under a hand lens. Ripple marks may be present on tangential surfaces, but are not always distinct, even under a lens. Pith flecks normally absent, but may be found in rare instances.

Ironbark

This is a tough, hard and strong timber of the Australian continent that is well known on all the markets of the world, being noteworthy for its exceptional durability. It is a member of the Eucalypt family of the Myrtaceæ, being the timber of *Eucalyptus paniculata*, a close botanical relative of the greatly esteemed Jarrah. Its weight is between 50 and 60 lbs. to the cubic foot, the grain is interlocked, and the texture coarse but uniform. The wood may range from greyish-brown to reddish-brown in colouring, and has a characteristic figure. Ironbark, sometimes called Grey Ironbark, is not an easy timber to work, and offers considerable resistance to such operations as nailing and screwing. The sapwood of the species is somewhat susceptible to powder-post beetle attack, whilst the heartwood is classified as impermeable to treatment with wood preservatives. It is a refractory timber to season. Available supplies of the wood are more than adequate to meet the present and probable future demands. Further details of the wood may be found in literature by Baker and by Cox.

Ironwood

This is a popular vernacular name to describe very hard and tough timbers, but to differentiate between them geographical prefixes are often used. Some of the most important varieties are dealt with below.

Canadian Ironwood is the timber of *Ostrya virginiana*, a hardwood having an average weight of between 55 and 65 lbs.

to the cubic foot, a shallowly interlocked grain, and a texture that is medium fine, or fine and uniform. The tree producing the timber is closely related to the Hornbeam (see above), but Canadian Ironwood does not rank as important as that timber on the world markets. It is a very difficult wood to work by hand, and is by no means easy to machine, but may be surfaced satisfactorily. The wood is classed as a naturally durable one when exposed to the weather. For a further description of Canadian Ironwood and its properties see Hale and McElhanney.

Ceylon Ironwood is a native of Ceylon, India and Malaya, and is a member of the Guttiferaceæ family. It is the timber of *Mesua ferrea*, a slow growing tree of medium height producing a darkish-red coloured wood. The timber is very hard, and is naturally durable for exposed positions, but is of limited use only.

East Indian Ironwood is the hardwood timber of *Metrosideros vera*, small quantities of which reach the United Kingdom markets. In addition to its use as a timber, East Indian Ironwood has certain medicinal uses. Under seasoning treatments the timber may prove refractory to handle. The timber is an extremely difficult one to work, whether by hand or by machine, has a marked dulling effect on tools, but has the merit of being naturally durable. Its uses are limited to those purposes where its hardness and toughness are an asset. No especial demand is likely to arise for the wood.

Uganda Ironwood is not a commercially important timber but is one that might gain great popularity if it were more readily exploitable. It is a fine textured, red-brown wood with an interlocked grain, having such a high standard of durability that it is regarded as well-nigh indestructible. For seasoning it is said to be refractory, and serious shakes and splits may develop during the process. Like all timbers of the same name it is difficult to work, whether under hand or machine tools, but can be brought to a good surface. It is the timber of *Cynometra alexandri*.

Black Ironwood, or South African Ironwood, is the product of *Olea laurifolia*, and is therefore closely related to the common Olive. The tree may grow to a height in excess of 50 feet, and the timber is one that is rather difficult to season, usually

checking badly whilst undergoing that process. Black Ironwood has a straight grain and a fine and uniform texture, with the sapwood and the heartwood sharply differentiated, the sapwood being a dull white and the heartwood brownish, with a figuring of black streaks. The timber is a naturally durable one that is difficult to work, and has a marked dulling effect on tool edges. It is important locally, but is never likely to achieve an important place on the general market.

Ivorywood

The tree producing this Australian timber is not a common one and the wood is accordingly scarce, but when it is available it is prized for such purposes as engraving, turnery, mirror frames, inlaying, and fancy articles. It works well in all hand or machine tool processes, and its dulling effect on cutting edges is hardly noticeable. Ivorywood is not a naturally durable timber, but is not of the class of woods customarily given a wood preservative treatment. Under seasoning treatments it is apt to prove rather refractory, and is somewhat subject to seasoning stain. Warps and splits are rather common in the converted stock, which is usually found to be rather brittle. Ivorywood is white in colour with a very indistinct growth ring figuring, and weighs between 48 and 58 lbs. to the cubic foot. The grain is normally straight and the texture fine and uniform. It is the timber of *Siphonodon australe*.

Another species known as Ivorywood is a native of the Argentine, Brazil, and other parts of tropical America, and comes from *Balfourodendron riedelianum*, but the timber is of local importance only. The sapwood and the heartwood of the species are not sharply delimited, the wood being a uniform whitish or pale yellow in colour, with a non-lustrous surface, no figuring, and no characteristic taste or fragrance. Average timbers weigh between 45 and 50 lbs. to the cubic foot when air dry, are straight grained, and have a fine and even texture. It is not a naturally durable timber for external use, but is sufficiently so for purposes under cover, and it works very well under tools, surfaces satisfactorily, and may be stained, polished, etc., with very good results.

Jarrah

Of all the Australian timbers Jarrah (also known as Western Australian Mahogany) is probably the best known and most popular on the world markets. It is the hardwood timber of *Eucalyptus marginata* and may range from pinkish to a dark rich red in colour, though the tint is uniform in any one specimen. The weight is variable, average specimens weighing anything from 45 to 60 lbs. to the cubic foot, the texture is moderately coarse but uniform, whilst the grain is variable. The timber is resistant to wood-rotting fungal, termite and teredo attack, and is difficult to impregnate with wood preservatives. It seasons remarkably well, though a certain amount of degrade may occur. Jarrah is not an easy timber to work, and although capable of taking a high polish it is frequently left unstained so as not to hide the unique and beautiful colour. The commonest defect to be encountered in the wood is evidence of pin-hole borer attack. Heavy duty flooring, wood blocks, cabinet work, panelling, and so on are amongst the uses to which the wood may be put. See literature by Baker and by Cox.

Juniper

This species (*Juniperus communis*) in itself is not an important source of timber supply, though it belongs to a genus that includes several useful commercial woods, usually described as Cedars. It is the timber of a small tree of Europe and the northern parts of Asia, and is a brownish coloured softwood timber with a mild and fragrant smell. It is an easy working wood, though somewhat brittle, but its degree of natural durability is high. Juniper creates no especial problems during seasoning processes, and does not warp to any extent. Although it is frequently somewhat knotty the wood may be used for veneering, turnery, etc., but the commercial importance of the tree rests on the "Oil of Juniper" it produces, though formerly the berries were of importance in the flavouring of gin. Juniper has a straight grain, a fine and uniform texture, and may weigh between 25 and 35 lbs. to the cubic foot.

Kapur

Kapur is the timber of various species of *Dryobalanops* of British North Borneo, Sumatra, Sarawak and the Malay

Peninsula, small quantities of which have been sold on the United Kingdom markets, though the wood is of considerably more local than universal importance. The timber (sometimes sold under the title of Borneo Camphorwood) has an average weight of 50 lbs. to the cubic foot, with the grain either straight or interlocked, and the texture coarse but uniform. The colour of the heartwood is light red-brown or red-brown in colour, and the wood has a characteristic smell of camphor. Kapur is rated as only moderately durable when exposed to the weather, whilst the sapwood is somewhat susceptible to powder-post beetle attack. The timber seasons well and is easy to work in all hand or machine processes. When in contact with iron the wood develops bad stains, and eventually the metal corrodes. Kapur is said to be very resistant to treatment with wood preservatives. See further details of the timber as given by Cox and by Desch.

Karri

This wood ranks next to Jarrah as the most popular of the Australian timbers exported to the world markets. The two timbers closely resemble each other, but may be distinguished by the "burning splinter" test in which a sliver of wood about the size of a match stick is burned; a white ash indicates that the timber is Karri, black charcoal residue that the wood is Jarrah. Karri is not a naturally durable timber, but the heartwood of the species is impermeable to preservative treatments. The wood is rather a difficult one to season and is hard to work, resembling Jarrah in this quality. It may be regarded as a non-ornamental general utility timber. Karri is the timber of *Eucalyptus diversicolour*, and has an average weight when air dry of 55 to 65 lbs. to the cubic foot. Its grain is either straight or very shallowly interlocked, with the texture moderately coarse but uniform. The colour ranges from pinkish to dark red, but is uniform in any one specimen.

Kingswood, Brazilian

Brazilian Kingswood, also known as Zebrawood (a name shared with the timbers of other very different species) is a rare but important timber that is extremely popular for the making of high-class furniture and similar purposes. It has an

average air dry weight of 55 to 65 lbs. to the cubic foot, a grain that is normally straight, and a texture that is both fine and uniform. The light-coloured sapwood is well distinguished from the heartwood, which may range in colour from a lightish-brown to a red tint, with darker stripes. It is naturally resistant to decay, though this is of no great importance as it is chiefly used for internal work, and the working and seasoning qualities are in general very satisfactory. The timber is produced by *Astronium fraxinifolium*, a hardwood species. See Record and Mell for a full description of the wood.

Kumbar

This hardwood timber (*Gmelina arborea* of the Verbenaceæ family) somewhat resembles Teak, but is lighter in weight and not so coarse grained. It has an average weight of between 30 and 40 lbs. to the cubic foot when air dry, a medium coarse, or coarse, and uneven texture, and an interlocked grain. The sapwood of the timber and the heartwood are not sharply differentiated, the wood being light brown in colour with no distinctive figuring and with no characteristic taste or smell. It is not a difficult wood to work though it is rather brittle, and it responds satisfactorily to most of the normal types of finishing treatment. Its natural durability is on the high side, but it is generally regarded as a non-ornamental cabinet wood rather than as a structural or general utility timber. In seasoning the wood creates few problems and the rate of degrade during the operation is not high. Its importance is almost purely local, but exhaustive tests of the wood have been made and may be studied in works by the standard writers on Indian Timbers.

Laburnum

Laburnum is the hardwood timber of various *Laburnum* species and is one of the comparatively few timbers that show a ring porous structure. It is the product of trees common to the north temperate regions, but the wood is of little economic importance, though small quantities of it may be found on the market from time to time. It is moderately durable in exposed positions, works reasonably well in all operations, reacts satisfactorily to the normal types of decora-

tive treatment, and turns with good results. The timber is straight grained, but the texture variable, and it has an average weight to the cubic foot of between 50 and 60 lbs. Sapwood and heartwood are well marked, darkish-brown in colour for the latter and yellowish for the thin sapwood, with a distinctive figuring but no characteristic taste or smell. Laburnum may be used for minor purposes such as inlaying, marquetry, turnery and small fancy articles. Chalk and Rendle give details of the anatomical structure, together with a microphotograph of the transverse section. The so-called Indian Laburnum is the wood of *Cassia fistula* of the Leguminosæ family. It is a strong and hard timber with a heartwood strongly resistant to termites and insects, but its economic importance is purely local.

Lancewood

Lancewood is the timber of *Oxandra lanceolata* of the Anonaceæ family, a botanical hardwood timber with an average weight of 60 to 65 lbs. to the cubic foot when air dry, a straight grain, and a fine and uniform texture. Only the sapwood is of any commercial importance, this being a darkish yellow in colour, whilst the heartwood is black, or almost black. Small quantities of the wood are often to be found on the general markets, though most of the trade is done with America, Jamaica and tropical America supplying the timber, which is strong and not naturally durable. Lancewood splits easily, and should be pre-bored for such operations as nailing and screwing, but otherwise it creates few problems in working, whether under hand or machine processes. The timber turns satisfactorily, and reacts well to the normal types of finish given to a wood of its nature. Typical uses include turnery, wheel spokes, parts of vehicles, shooting sticks, tool handles, billiards cues, and other purposes for which an elastic timber is of value. Amongst others, Cox, Record and Mell, and Winn, may be consulted with advantage for further details of the wood, including its anatomical structure and mechanical properties. Tasmanian Lancewood, of local importance only, comes from the *Phebalium squameus*.

Macroscopic identification features of Lancewood

Diffuse porous structure. The growth rings are not distinct to the naked eye; boundaries marked by narrow layers of denser fibres. Vessels not distinct to the naked eye but distinct under a hand lens; many in number; solitary, or in small groups; simple perforations; gum and crystal deposits present. Vessel lines fine; not distinct to the naked eye. Rays heterogeneous; distinct to the naked eye on transverse section; usually invisible on tangential surface. Metatracheal type of wood; parenchyma present in narrow concentric bands. Ripple marks not present. Pith flecks not present.

Lancewood, Burma

Burma Lancewood has an average weight per cubic foot of between 60 and 65 lbs., is straight grained, has a fine, or very fine, and uniform texture, and is a botanical hardwood with a heartwood that is light red-brown in colour. The timber is the product of a tall tree—*Homalium tomentosum*—native to Burma. The wood is a very strong one, but usually refractory under seasoning treatments when it is apt to develop end splits and cracking. The wood is not well known on the world markets in general, but in India it finds considerable use for such purposes as the making of agricultural implements, as well as being a structural timber. Supplies are abundant to meet present and future demands, though it is possible that the latter might be bigger if the tree was capable of being more easily exploited and was better known to wood consumers. For literature regarding the timber see Pearson and Brown's work *The Commercial Timbers of India*.

Larch

The product of a tree of the mountainous regions of southern and central Europe and parts of Asia, Larch is a softwood and is the timber of *Larix europea*. The tree is of rapid growth habit, and may reach to a height of 80 feet, living for a period of more than two centuries, though it may be felled for timber when about forty years old. It is a moderately heavy timber, its range being from 30 to 40 lbs. to the cubic foot, has a reasonably fine and uniform texture, and is usually straight grained; the wood is reddish- or brownish-white in colour, with a

distinctive growth ring figuring. Under seasoning treatments the timber is apt to warp and shrink considerably, but it is markedly free from knots, and is regarded as being amongst the most naturally durable of all the conifer timbers, and is often favoured for exterior work in preference to other softwood species. The tree is also of importance in that it yields "Venice Turpentine", having a medicinal value, and also tannin. The living tree is often attacked by the fungal disease known as "larch canker" which causes early death.

Larch, Western

Like the other *Larix* species this timber is classed as very strong for a softwood, and is also naturally durable against the attack of wood-rotting fungi; it is the timber of *Larix occidentalis*, and may also be offered for sale under the name of Western Tamarack. Whilst undergoing seasoning processes Western Larch is somewhat refractory, and checks and warping are not uncommon defects to be found in converted timber of the species. The working qualities of the wood are good without being exceptional in any way. It is lighter in weight than European Larch, averaging 28 lbs. to the cubic foot in an air dry condition, but the grain and texture are comparable with those of the European wood; in colour it is a reddish-brown, and it has a very distinctive figuring caused by the noticeable contrast between the early wood and the late wood. The timber is not of any great importance for export purposes, but in Canada it is used for railway sleepers, flooring, piling and plywood, as well as a structural timber. See the study by McElhanney. The *Larix americana* also produces a useful, though often cross-grained, timber that is sometimes described as Tamarack or Hackmatack.

Lauan

This is one of the very few Philippine timbers to reach the general market, though not unnaturally the bulk of it goes to America. It is sometimes exported under the title of Philippine Mahogany, but is not a member of the true Mahogany family. Various species of *Shorea* of the Dipterocarpaceæ family may go to make up the consignments, and the timber is available in good dimensions. Qualifying titles such as Red and White

are recognized. Red Lauan normally has a deeply interlocked grain that gives quarter-sawn stock a prominent striped figuring, whilst the heartwood is red or a dark red-brown in colour; the texture is coarse and uneven. The wood is sufficiently durable for all interior purposes, and is in demand for such items as cabinet and furniture making, veneers, musical instruments, and so on. It works well, but has a tendency to warp during seasoning. White Lauan is usually provided by the *Pentacme contorta*. It is not as durable as Red Lauan and contains numerous resin canals that may limit its usefulness. In weight the Lauans may range between 40 and 50 lbs. to the cubic foot, and the surface is generally slightly lustrous. Texture is variable from reasonably fine to definitely coarse, but seasoning and working qualities are good. White Lauan may be used for much the same purposes as the Red. The Mindanao Lauan is of lesser importance as a timber, but conforms closely to the preceding varieties.

Laurel

The Mediterranean regions are the natural home of the European species of this timber, the tree (*Laurus nobilis*) growing to a height of some 50 feet under favourable conditions. It is, however, widely cultivated, being used principally as a shade tree, though its importance as a timber is negligible. The straight or occasionally interlocked grained wood has the typical mild fragrance of the Lauraceæ family, but has no distinctive taste. Laurel is whitish in colour, sometimes showing a light reddish tint, and has a texture that may vary from fine to moderately fine, and uniform. Sometimes known as Bay Laurel, the tree is also the source of a volatile oil that is an important article of commerce. The wood is suitable for small novelties, carvings, inlay and marquetry, but is otherwise of little use. Seasoning and working qualities are quite satisfactory, and it is only moderately heavy in weight. The degree of natural durability is not high.

Laurel, Indian

The so-called Indian Laurel ranks as one of the most important of all the native Indian softwoods. It is the timber of *Terminalia tomentosa*, and has a variable grain, a coarse and

uneven texture, and an average weight of from 50 to 60 lbs. to the cubic foot for air dry specimens. The sapwood and the heartwood of the species are clearly defined, the former being a reddish-white in colour, with the latter ranging from a light brown to a deep chocolate shade, and showing darker, irregular markings. It is hard, dense, and rather difficult to season, and is, accordingly, often girdled as a pre-seasoning treatment. Indian Laurel is naturally resistant to the attack of all forms of wood-rotting fungi, though the sapwood seems to be susceptible to powder-post pest attack; this latter fact is not of considerable importance as the wood reacts very well to wood preservative treatments. The timber is somewhat difficult to work by hand, but machines satisfactorily; nailing may be found difficult, but glue adheres firmly, and the timber also turns and polishes well. It may be used for such items as furniture manufacture, cabinet making, veneers, panelling, and so on. For further details of Indian Laurel see the full study of the wood as made by Pearson and Brown.

Macroscopic identification features of Indian Laurel

Diffuse porous in structure. Growth rings distinct to the naked eye; boundaries shown by layers of terminal parenchyma. Vessels medium-sized to large; open, or may be filled with gum deposits; numerous tyloses; simple perforations. Vessel lines very distinct to the naked eye. Rays homogeneous; fine, but visible under a hand lens; crystals not present in the ray parenchyma cells. Abundant paratracheal wood parenchyma; thin terminal parenchyma marking growth rings; sparse metatracheal parenchyma present; crystals abundant in wood parenchyma cells. Ripple marks not present in the species. Pith flecks not present.

Lignum Vitæ

Many generalizations such as "the hardest timber in the world" have been made about Lignum Vitæ, but this and similar statements are not entirely accurate. The wood is, however, very hard, and it is a difficult one to work whether by hand or by machine. Lignum Vitæ turns excellently, and is naturally resistant to the attack of all types of wood-rotting fungi. A steady demand exists for the wood for certain

specialized purposes, and though it is expensive there has so far been little difficulty in fulfilling orders. It is a very heavy hardwood with an average weight of some 73 to 80 lbs. to the cubic foot, with a narrow yellowish or whitish sapwood, and a heartwood dark greenish-brown to blackish in colour; the wood has a characteristic pleasant smell coupled with a bitter taste. *Lignum Vitae* is suitable for such items as pulley sheaves, stencil blocks, rollers, and bowlers' "woods". Studies of the wood have been made by Cox, Record and Mell, and Howard, amongst others. The timber is the product of *Guaicum officinale*, and is so naturally oily that it has very marked qualities of self-lubrication which makes it especially suitable for some of the purposes mentioned above, and for wooden bearings.

Macroscopic identification features of *Lignum Vitæ*

Tendency to be ring porous in structure. Growth rings lacking or indistinct. Vessels very small and vary in distinctness; occasionally in radial rows; gum and resin deposits abundant; simple perforations. Vessel lines normally indistinct and not visible to the naked eye. Rays fine and numerous; invisible to the naked eye on transverse section and tangential surface; not distinct on radial surface; may be seen under a lens; heterogeneous; mostly uniseriate. Wood parenchyma not distinct to the naked eye but quite distinct under a hand lens; narrow sheaths of vasicentric parenchyma round the vessels, and parenchyma in tangential lines also present. Ripple marks present but not visible to the naked eye; under a hand lens they can be seen as being very close together (the timbers of this particular family have more ripple marks to the inch than has any other timber). Pith flecks not present.

Lime

Lime, or Linden, is the timber of *Tilia vulgaris*, a moderately lightweight hardwood with an air dry weight of between 32 and 40 lbs. to the cubic foot. It is a straight grained, fine and uniformly textured wood; whitish or pale yellow to light brown in colour, with no distinctive taste or smell, and no figuring. In general appearance it closely resembles the Poplar and Willow. The tree producing the timber is common in Russia,

Germany and England, and is a member of the same botanical family as the Basswood (see above). The stock is not normally available in timbers of large dimensions, but it is a close grained wood that is excellent for carving purposes. The wood is not a naturally durable one, but is not of the type of timber normally given a treatment with preservative. It works well under all operations, and once the seasoning process has been completed the wood is more stable than the average. Ample supplies of the timber exist to meet larger demands than are customarily made for it. Typical uses include carving, inlaying, marquetry work, cabinet making and small fancy articles. A study of the wood has been made by Chalk and Rendle.

Macroscopic identification features of Lime

Diffuse porous in structure. Growth rings reasonably distinct to the naked eye, and showing an undulation between the rays. The vessels are many in number; irregular in section; variable in size but never very large; simple perforations; vessels arranged in tangential lines or groups; open. Vessel lines reasonably distinct to the naked eye. Metatracheal type of wood parenchyma but not always to be seen with a lens. Rays fairly distinct to the naked eye. Ripple marks not present in the species. In view of its similarity to many other timbers, positive identification is best made on microscopic and not macroscopic features.

Locust, West Indian

This timber is best known on the American markets, being the product of a tall tree common to the American tropics. In addition to its timber the tree (*Hymenaeae courbaril*) also yields "South American Copal Gum" which is an important item of commerce. West Indian Locust is not an easy timber to work by hand, but is markedly less difficult by machine, and finishes smoothly under a machine planer. It is not resistant to the depredations of wood-rotting fungi, and finds its principal use in positions protected from the weather. It is a hardwood timber with an average weight of 55 to 65 lbs. to the cubic foot, variable as regards grain, with a medium coarse and uneven texture. The sapwood is broad, pinkish to yellowish in colour, whilst the heartwood is orange to dark brown; the wood has a pronounced silver grain figure on

quarter-sawn surfaces. Typical uses for the timber (which may be sold as South American Locust, Courbaril Plum, or Locust Gum) include furniture, cabinet making, ship-building, boat-building, carpentry and similar purposes. The West Indian Locust is normally available in timbers of good dimensions. See Record and Mell for a full description of the timber's properties.

Macroscopic identification features of West Indian Locust

Diffuse porous. Growth rings distinct to the naked eye, boundaries being indicated by lines of terminal parenchyma. Vessels large and distinct to the naked eye; solitary, or subdivided radially; few in number; mostly open; simple perforations. Vessel lines distinct to the naked eye. Rays fine; usually visible to the naked eye on transverse sections; distinct on the radial surfaces; frequently invisible on the tangential surfaces. Wood parenchyma in concentric lines or bands; also aliform about the vessels, with a tendency to become confluent; terminal parenchyma delimiting growth rings also present. Vertical gum ducts occasionally present. Ripple marks not present in the species. Pith flecks not present.

Logwood

Logwood, which is the hardwood timber of *Haematoxylon campechianum*, has an air dry weight per cubic foot that varies between 60 and 65 lbs. The grain is interlocked, and the texture coarse but fairly even, the heartwood and the sapwood being very sharply distinct, the former bright red and the latter whitish or yellowish. The wood has a distinctive sweet taste and a smell that resembles that of violets. Small quantities of the timber are imported in the form of logs of slender dimensions, but the economic importance of the tree rests on its usefulness in the dyeing industry rather than as a source of timber, though the wood is occasionally used for such secondary purposes as marquetry and inlaying; the wood also has certain medicinal uses. The timber is strong but brittle (needing pre-boring for nailing or screwing) and is durable for use in positions where it is exposed to the weather or rests in contact with the ground. It is a rather difficult wood to work by hand, but may be finished to a very smooth surface and takes a high polish. The study of the timber made by Record and Mell may be consulted with advantage.

Macroscopic identification features of Logwood

Diffuse porous structure. Growth rings reasonably distinct to the naked eye, boundaries being indicated by lines of terminal parenchyma. Vessels small but visible to the naked eye; solitary, or sub-divided radially; gum deposits common; whitish deposits also present. Rays fine; visible to the naked eye on transverse section and radial surface; not visible to the naked eye on tangential surface. Fine lines of terminal parenchyma marking the growth rings are present; parenchyma of the confluent type may also be present. Ripple marks not present. Pith flecks not present.

Mahogany, African

The name of this West African timber may be preceded by the name of the port or district from which the shipment was made, such as "Lagos", etc. It is the hardwood timber of *Khaya ivorensis*, with an interlocked grain and a coarse texture, having an average weight of anything from 30 to 40 lbs. to the cubic foot when air dry. The sapwood and the heartwood are not always well distinguished, the colour varying from light brown to a deep reddish, with radially sawn timbers showing a striped or roe figuring. The wood seasons without undue difficulty either in air or in a kiln, though slight warping may occur. Compression failures and pinhole borer galleries are common defects in converted stock. African Mahogany is reasonably durable though the sapwood is liable to infestation by powder-post beetles. It works easily and finishes to a good surface, and may be given any of the normal kinds of finishing treatment with satisfactory results. A brief study of the timber is included in "A Handbook of Empire Timbers". A closely related species (*Khaya senegalensis*) is known as Senegal Mahogany and may be exported in small quantities. It is heavier than the African Mahogany, but may be used for the same purposes.

Mahogany, Brazilian

This is not a true Mahogany but is the timber of *Cariniana legalis* of the Lecythidaceae family. The tree is of tall growth habit, and the wood averages between 30 and 40 lbs. to the cubic foot when fully seasoned. Straight grained, the timber has a

fine and uniform texture. In colour the wood is pinkish-brown or light red, but the figuring, both on flat-sawn and quarter-sawn stock, is not particularly striking. The working qualities are good, though there is a tendency to brittleness, whilst the rate of degrade during drying processes is low. The wood may be used for the same purposes as the true Mahoganies. A very closely related species botanically is the *Cariniana pyriforma*, which produces the Columbian Mahogany that occasionally reaches the European markets, though most of it goes to the Americas. This is superior to the Brazilian as a timber in almost all respects, and has the typical brown colouring of true Mahogany with a noteworthy and beautiful figuring. Average specimens are rather heavier in weight than those of Brazilian Mahogany, but in other properties the woods are very much akin. Both timbers are alike in that they remain remarkably stable after seasoning. It is possible that a good market could be created for both timbers were supplies available. For literature consult Record and Mell.

Mahogany, Honduras

Honduras Mahogany is the timber of *Swietenia mahogani*, and may reach the market under such titles as Spanish or Cuban Mahogany, or Baywood. Its weight may vary between 35 and 48 lbs. to the cubic foot, the grain is straight, and the texture medium fine and uniform. The sapwood and the heartwood are very distinct, the former being almost colourless and the latter normally a dark reddish-brown; the wood has a lustrous surface. True Mahogany is the product of a tree that grows to a considerable height and large timbers free from knots are easily obtained. After seasoning the wood is very stable and its relative freedom from "working" has made it one of the favourite panelling woods. The timber is not a naturally durable one and is frequently attacked by pin-hole borer pests, but it is very rarely used for exterior work. Mahogany is reasonably easy to work but is somewhat inclined to be brittle; it bends moderately well and polishes excellently. Typical uses for the timber include furniture, aeroplane propellers, panelling, veneering, cabinet making, printers' blocks, joinery, shop, hotel, and bank fittings, etc. Studies of Honduras Mahogany are included in works by Cox; Howard; Record

and Mell; Stone. Another true member of the Mahogany family is the Broad-leaved Mahogany (*Swietenia macrophylla*), but it is unlikely to be marketed under this name.

The name of Mahogany is a favourite descriptive one for tropical hardwoods, even though they are not members of the Meliaceae family. Some timbers bearing the title of Mahogany are: Gaboon Mahogany (*Aucumea klaineana*), often used for panelling and plywood, Budongo Mahogany (*Entandrophragma angolense*), Australian White Mahogany (various species of *Eucalyptus*), whilst other so-called Mahoganies are prefixed by such titles as Uganda (see below), Java, Red, Rose, Tenasserim, Miva, Mufumbi, and so on. In general all such timbers have the colour of true Mahogany and may be used for much the same purposes, but they are normally only of local economic importance.

Macroscopic identification features of Honduras Mahogany

Diffuse porous in structure. Growth rings usually quite distinct with the boundaries marked by terminal parenchyma. Vessels visible to the naked eye; uniformly distributed; solitary, or in radial groups; usually open, but white or gum deposits may be present. Vessel lines distinct to the naked eye. Rays fine, and rather variable as regards their distinctness. Inconspicuous paratracheal parenchyma about the vessels and groups of vessels; metatracheal lines or bands of parenchyma also present, in addition to the terminal parenchyma that marks the growth rings. Occasional gum ducts present. Ripple marks visible on tangential surfaces. Pith flecks not present.

Mahogany, Uganda

This wood, at present only to be found in small quantities on the European markets, is one that has many important uses that fit it for wider employment than it has hitherto enjoyed. It is an excellent hardwood timber for cabinet making, veneering, plywood manufacture, high-class joinery and furniture, and many similar purposes, and can be obtained in boards of wide sizes. The timber is said to season well, and it is easy to work, though where the grain is deeply interlocked there is a tendency to pick-up when being machine planed. It is not classified as a durable wood in exposed positions, but this is

unimportant in view of the uses for which the timber is most suited. Uganda Mahogany is closely related to Senegal and African Mahogany (see above), being the timber of *Khaya anthotheca*, is moderately coarse and uniformly textured, with a grain that is either straight or interlocked, whilst with quarter-sawn stock there is a slight stripe figure. It has a range of colour from light brown to dark red in the heartwood and is moderately heavy, average weight being 30 to 40 lbs. to the cubic foot. Amongst various alternative names Mangona and Duala Mahogany are titles commonly given to the wood.

Maple

Various species of Maple are to be found in Europe, Asia and America, but it is on the latter continent that it achieves its greatest importance as a timber. The American species are dealt with below. In general the Old World species are pale brown in colour, showing a distinctive growth ring figuring, and have an average weight of between 40 and 50 lbs. to the cubic foot when fully air dry. The working qualities of the timber are satisfactory provided that tools are kept keen, and it will both turn and carve with good results. The grain of the timber is normally straight, and the texture fine and even. Maple reacts well to almost every form of decorative treatment, and in particular is capable of giving a good glaze with wax polishes. Sufficiently durable for all purposes under cover, it is not difficult to handle in seasoning processes, whether by natural or heat treatments. Furniture manufacture, cabinet work, flooring, musical instruments, panelling and wainscoting are amongst the uses that may be quoted for this timber. Common Maple is the timber of *Acer campestre*. Other species include the Norway Maple (*Acer platanoides*) which is native to northern Europe, but also to be found in America, the Japanese Maple (*Acer palmatum*), lighter both in colour and weight than the Common Maple, and the Himalayan Maple which finds considerable use in India. All these species are akin in their general nature and properties, but are rarely, if ever, marketed under these specific names, with the possible exception of the Norway Maple.

Macroscopic identification features of Maple

Definitely diffuse porous in structure with the growth rings distinct to the naked eye. The vessels are small in size; diffuse in distribution; round in end-section; solitary or else in small radial groups; deposits in the vessels are of quite frequent occurrence. Vessel lines are quite visible to the naked eye. Rays are fine though clearly visible on the radial surface but are not conspicuous on other surfaces. Ripple marks are not present in the genus, but frequently mineral streaks are to be seen on longitudinal surfaces.

Maple, Queensland

The hardwood timber of *Flindersia brayleyana* has long been deservedly popular on the world markets; it is a member of the family Rutaceae. The timber is pinkish when freshly cut, has a mild and characteristic smell, and darkens with age to a light brown, with a lustrous surface and a bold, distinctive figuring. Quarter-sawn stock produces the best timber for most purposes, and the so-called bird's-eye and watered silk figurings are common and greatly prized for decorative work. The grain may be either straight, wavy or interlocked, with the texture medium coarse but even, average samples weighing from 35 to 40 lbs. to the cubic foot, air dry. Queensland Maple is not naturally resistant to the ravages of decay but is durable for the purposes for which it is commonly used, these including panelling, turnery, cabinet making, furniture, wainscoting, musical instruments, etc. The principal defects likely to be encountered with the wood include warping, cupping, and collapse with kiln seasoned timbers. The wood works easily, turns well, and reacts satisfactorily to the normal types of finishing treatment. It is not a true Maple and may be offered for sale as Maple Silkwood, Silkwood, or Australian Silkwood, the last name being uncommon. Literature by the following authors may be studied: Cox; Howard; Stone; Swain.

Macroscopic identification features of Queensland Maple

Diffuse porous in structure. Growth rings indistinct to the naked eye. Vessels small to medium in size; uniformly distributed; solitary, and also in short radial rows, the latter occur-

ring most frequently; crystal deposits present; simple perforation plates. Vessel lines distinct to the naked eye. Rays fine, but readily visible to the naked eye on transverse section; prominent on radial surfaces. Wood parenchyma scanty; some paratracheal and also occasional diffuse metatracheal parenchyma present; crystals may be present in wood parenchyma cells. Vertical intercellular canals may be present. Ripple marks do not occur in the species. Pith flecks not present.

Maple, Rock

Rock Maple may be given the alternative names of Sugar Maple, Hard Maple, or just plain Maple. It is the timber of *Acer saccharum*, and is a hardwood with an average range of weight of between 42 and 52 lbs. to the cubic foot, the grain either straight or curly, and the texture fine and uniform. The timber is a lightish brown in colour and has a distinctive growth ring figuring. It is one of the most popular furniture and cabinet woods of the American market, and is the product of a tree to be found growing in Canada, Newfoundland, and the northern United States. It is not a naturally durable timber, and is difficult to impregnate with wood preservatives. Nor is it an easy timber to work, but it can be brought to a good surface and it will turn well. The shrinkage factors are high, and it seasons slowly, but it is not awkward to handle under the treatment. Typical uses for the timber include panelling, veneers, plywood, furniture, heavy duty flooring, and cabinet making, but the tree is also the source of Maple Sugar and Maple Syrup. Studies of the timber are included in works by Cox; Hale; Howard; McElhanney; Sargeant. Other North American species include the Red Maple, also known as the Swamp or Soft Maple, the Black Maple (*Acer nigrum*), with a reddish-brown heartwood and whitish sapwood, but not as dense and hard as the Rock Maple, and the Striped Bark Maple (*Acer striatum*) of little importance as a timber. The Silver Maple (*Acer saccharinum*) is not as highly esteemed as the Rock Maple, but provides a lighter weight reddish-brown timber that finds considerable use, though its durability is not as high as that of the hard Maple. The Philippine Maple is the *Acer niveum*.

Macroscopic identification features of Rock Maple

Diffuse porous in structure, the growth rings being fairly distinct to the naked eye. Vessels moderately small to medium in size; solitary, or in radial groups; diffuse distribution; crystal deposits common. Vessel lines visible to the naked eye. Rays inconspicuous on the transverse section but conspicuous on radial surface, quarter-sewn wood having a prominent ray figuring. Ripple marks not present in the species. Pith flecks not present.

Maple, Rose

This is the timber of *Cryptocarya erthyroxylon* and botanically is a hardwood with a range of weight of from 40 to 50 lbs. to the cubic foot when fully seasoned. Generally the grain is straight but it may be slightly wavy, though the texture is almost invariably coarse but uniform. The heartwood of the timber ranges from palish brown to brownish in shade, with orange or pink tints, quarter-sawn surfaces showing a ray figuring; the wood has no distinctive taste but has a rather characteristic fragrant smell. Rose Maple is a moderately durable timber for external use and is the product of a tree native to New South Wales and Queensland. It is used in Australia for such purposes as cabinet making, panelling and wainscoting, but the wood is not well known on the general market and it has no outstanding characteristics that are likely to result in a demand for supplies from places outside its native continent. Studies of the wood have been made by Baker and by Swain amongst others, and these may be consulted for full details regarding anatomical structure, strength properties, etc.

Marara, Rose

Only very limited supplies of this timber are available, these being exported from Australia. It is the timber of a botanical hardwood *Geissois lachnocarpa*. Rose Marara is regarded as a general utility timber though it is not a naturally durable one and is not suited for exterior work. The wood works well under tools, finishing to a clean surface, and its turning qualities are also satisfactory; its dulling effect on tools is so small that it may be ignored. Under seasoning treatments, both air and kiln, it may prove somewhat difficult to handle, and checks

and splits are often to be found in the converted stock. It is not a resilient timber but its strength factors have been proved by laboratory tests to be on the high side, and it is also a good wood for such work as engraving. Normally the timber is straight grained, and has a fine and uniform texture, the heartwood being rose-red to light mauve in colour, with quarter-sawn wood having an indistinct ray figuring. The wood weighs between 50 and 60 lbs. to the cubic foot. Various studies of the wood have been made in detail by the standard writers on Australian timbers.

Marblewood, Andaman

Andaman Marblewood is a straight grained, fine and evenly textured hardwood that has an attractive figuring of dark or black bands on a grey-brown or a light grey background. The timber is the product of a tree (*Diospyros marmorata*) of the Andaman and Nicobar Islands, and it is probable that it would be greatly esteemed as a decorative timber if supplies of it were more readily obtainable. At present the bulk of the timber goes to the neighbouring Indian markets. The tree is of the same genus as that supplying the true Ebonies, and Marblewood shows all the characteristic advantages and disadvantages of that timber. It is not an easy wood to season, and is difficult to work, though it is an excellent timber for carving and turning. The wood is classified as durable in exposed positions, though this property is of little importance for the purposes for which it is customarily used. Typical uses for the wood include carving, inlaying, turning, fine cabinet making, and so on. Andaman Marblewood is sometimes given the name of Zebrawood, though this title belongs to the timber of *Connarus guianensis* from Guiana and many other species, which, like the timber under reference, are principally of local importance.

Macroscopic identification features of Andaman Marblewood

A close botanical relative of the true Ebony, being of the same genus and showing the same features. See details as under Ebony.

Meranti

This is a Malayan hardwood timber, the product of various *Shorea* species. Two varieties are recognized, the Red and the Yellow, the former being probably the better of the two. The Red Meranti is variable as regards hardness, but is not really difficult to work whether under hand or machine processes, and it finishes cleanly. The non-figured heartwood may range from greyish through shades of red to dark red in colour, the grain is either straight or somewhat irregular, whilst the texture is coarse but uniform; the weight per cubic foot of the fully seasoned wood ranges between 25 and 35 lbs. Red Meranti is not naturally durable, but is used locally for bridge building, house construction, etc., as well as for planking and furniture. It is a very resinous wood. Supplies are more than adequate to meet the present export demands, but if these should increase difficulties might be experienced in getting the timbers out of the forests. The Red Meranti is usually provided by the *Shorea acuminata*. The Yellow Meranti is normally heavier than the Red, and is decidedly yellow in colour. It is naturally durable and is said to be difficult to impregnate with wood preservatives. Yellow Meranti is also said to be stronger than the Red variety, and is more frequently used as a structural timber, more especially as it is a non-ornamental wood. For further particulars of both timbers see Cox, and also Desch.

Mora

Mora, though not to be described as a timber that is well known on the world markets, ranks as one of the most, if not the most, important timbers of British Guiana, although its uses are somewhat limited. It is closely related to the Mulberry (see next entry) as it is the product of *Mora excelsa*, and it has an average weight of 50 to 60 lbs. to the cubic foot when fully seasoned; the grain is straight and the texture coarse and not uniform. The sapwood and the heartwood are well distinguished, the wide sapwood being yellowish, and the heartwood reddish-brown in shade with a figuring of darker lines. There is no typical fragrance to the wood, but it has a bitter taste. Mora is said to be naturally resistant to decay when exposed to conditions favourable to its attack, and the wood is hard and rather difficult to work by hand. Typical uses for the timber

include ship-building, paving blocks, railway sleepers and so on. Sufficient supplies of the wood are available to meet the present demand, and there is little likelihood of that demand being increased, as it has little to recommend it over other timbers better known to the trade. See Record and Mell on this wood.

Mulberry

Mulberry is the timber of various species of *Morus*, and is an irregularly grained, coarse and uneven textured hardwood, yellow to red-brown in colour in the heartwood, and with an average weight of from 35 to 45 lbs. to the cubic foot. It is not an important timber on the world markets, though the tree exists in commercial availability in the temperate and sub-tropical regions of the northern hemisphere. It is an awkward wood to handle under seasoning treatments, and it is not resistant to the ravages of wood-rotting fungi, though it is durable enough for use in protected positions. The timber is primarily a cabinet wood and is mildly decorative in that quarter-sawn stock has a well marked silver grain figuring. In most hand and machine operations the wood works well, and it turns rather better than its uneven texture would seem to indicate; under steam treatments the wood bends well. Studies of the timber have been made by Chalk and Rendle, and also Winn. Although normally marketed in common with other *Morus* species as Mulberry, the Red Mulberry (*Morus rubra*) may occasionally reach the market under its more distinctive name. Although the tree will grow in Europe it is really a native of the North American continent, reaching its best development in the lower regions of the Mississippi basin, where it may reach a height of some 70 feet. In general the properties of the wood conform with those of common Mulberry, though Red Mulberry is slightly the heavier of the two timbers, somewhat harder, and consequently rather more difficult to work. It is reasonably strong for its weight (38-48 lbs. to the cubic foot) and is generally regarded as a cabinet wood. Reddish-brown in colour and with an irregular grain, Red Mulberry has a finer and more uniform texture than is customary with common Mulberry. The Indian Mulberry is the *Morus indica*, and its properties have been treated at length by Pearson and Brown.

Macroscopic identification features of Mulberry

Ring porous in structure. Growth rings normally very distinct to the naked eye, the boundaries being marked by the large early wood vessels. Early wood vessels large and conspicuous; tyloses normally present; whitish lime deposits may be present; late wood vessels in scattered groups. Vessel lines quite distinct to the naked eye. Rays distinct to the naked eye; broad; conspicuous on the radial surface; heterogeneous. Vasicentric type of wood parenchyma, and sparse metatracheal type of wood parenchyma present. Ripple marks not present in the genus.

Myrtle

Although this is a member of the same botanical family as that producing the important Australian *Eucalyptus* varieties, this timber—the product of *Myrtus communis*—is of little commercial importance. The tree producing the wood is of medium growth habit, and is common to the Mediterranean regions and the more temperate parts of Asia; the bark of the tree is often used for tannin extraction. With seasoning treatments the lightish coloured wood is very refractory to handle, and it is difficult to handle in all hand or machine processes, largely because of its irregular grain. Timber of the species normally weighs between 45 and 55 lbs. to the cubic foot, and the texture is moderately coarse and not uniform. No special demand exists for the timber, and no demand is likely to arise for it. The Tasmanian Myrtle, also known as Myrtle Beech or Australian Myrtle, is a hardwood, the timber of *Nothofagus cunninghamii*, with an average weight of 46 lbs. to the cubic foot, a straight or shallowly interlocked grain, and a very fine and uniform texture. It is a timber of Tasmania and the southern and eastern regions of Victoria, and is a reasonably durable wood that seems to be rather susceptible to sap-stain fungal infection. Tasmanian Myrtle works reasonably well, whether by hand or by machine, finishes to a clean surface, turns satisfactorily, and reacts well to most of the types of wood finishing treatment customarily given to a timber of its class. Typical uses for the wood include cabinet making, turnery, shoe heels, flooring, piano cases, etc. The sapwood is almost colourless and the heartwood pink or pinkish-brown. The wood

is never likely to become an important factor on the world markets. See notes on the timber as made by Baker.

Nettlewood

Nettlewood is the timber of *Celtis australis*, a straight grained, medium coarse and uneven textured hardwood, with a weight that may run between 35 and 45 lbs. to the cubic foot for fully seasoned specimens. The sapwood and the heartwood of the timber are not sharply delimited, the wood being yellowish in colour with an indistinct figuring on flat-sawn faces and a ray flecking on quarter-sawn surfaces. Shot-hole borer galleries and evidence of sap-stain fungal infection are sometimes to be found in the converted timber of the species, but the wood is said to season easily, and its percentage of degrade to be not particularly high. It is tough and elastic, but works well, and is rated as reasonably durable for use in positions favourable to decay. Nettlewood is not an ornamental timber and it has few uses for interior work. Typical uses for the wood include such items as wheelwrights' work, bentwood articles, tool handles, and all other purposes for which a resilient timber is needed. Supplies of Nettlewood are probably more than adequate for the normal demand, and the timber is not well known on the general markets of the world, though used in Australia and India, and it is not likely to become popular. Studies of the wood have been made by Pearson and Brown, and by Winn.

Oak

This is a common name used to describe hard and strong timbers, though the true Oaks belong to the genus *Quercus* of the Fagaceæ. Some of the more important Oaks are treated in separate entries below, and details are also included of other Oaks of commercial importance, though not true Oaks.

English Oak is the timber of *Quercus robur*. In weight it may range between 40 and 50 lbs. to the cubic foot, the grain is generally straight but the texture coarse and not uniform. The sapwood and the heartwood of the timber are normally not sharply delimited, the sapwood being lightish in colour, whilst the heartwood may range from the same tint to a warm, rich brown. Flat-sawn timber has a very distinctive figuring, whilst radially cut stock has a very pronounced silver grain figuring.

Of all the true and so-called Oaks this timber enjoys the greatest popularity, though it is very variable in its quality. It is a naturally durable timber that does not create any special problems in seasoning, but the presence of gallic acid in the wood causes erosion of ironwork fastened into it. The wood is only moderately difficult to work, glues and screws well, fumes and stains very satisfactorily, and may be french polished if the grain is properly filled, though better results are obtained by wax polishing. The following may be quoted as examples of typical uses for the wood: furniture, panelling, interior fittings, railway sleepers, coffins, cooperage, cabinet making, dowels, musical instruments, ship-building, wainscotting, mouldings. Oak has a commercial importance apart from its use as a timber in that the bark yields tannin in considerable quantities. For studies of Oak see books by Chalk and Rendle; Howard; Stone; Winn.

Japanese Oak has been imported into this country from time to time, principally in the form of veneer and thin sanded panels. The wood is coarser in texture than the European species, and is normally much lighter in colour. It is easier to work than the majority of true Oaks, and the silver grain figuring is less prominent. Japanese Oak is not obtainable in big dimensions, and is the timber of *Quercus grossesserrata*.

Indian White Oak is not rated as a commercially important wood, and in its region of natural growth is often used only for fuel or charcoal. It is the product of *Quercus incana*, with a warm reddish-brown coloured heartwood.

Dyer's Oak is of some importance in that the bark yields a preparation in use in the dyeing and tanning of leather. It comes from the *Quercus tinctoria*, but is of insignificance as a wood.

Baltic Oak is provided by the same species as that furnishing the common English Oak, but is usually less strong and of smaller dimensions than our home-grown timber. It is sometimes classified by the title of its port of shipment as "Memel", "Danzig", etc., Oak, and in general its working and other qualities are the same of those of the English wood, but in seasoning treatments it is often found to develop cup shakes. A considerable export trade is done with the timber, but when-

ever available the home-grown timber is to be preferred for almost all purposes.

Riga Oak is a continental species most abundant in southern Russia. It is provided by the *Quercus sessiliflora*, one of the two sub-varieties that have now been amalgamated into *Quercus robur*. Although a timber of considerable importance Riga Oak is not as highly regarded as Danzig or English timber, as it is neither as hard nor is it as naturally durable as either of those two woods. The colour, too, is a lighter shade of brown.

Macroscopic identification features of Oak

Ring porous in structure. Growth rings quite distinct to the naked eye; boundaries indicated by the large vessels of the early wood as compared with the much smaller vessels of the late wood. Vessels large in the early wood and smaller in the late wood, though the latter are visible under a lens; numerous; round in end-section; radial in arrangement; numerous tyloses in the heartwood. Paratracheal type of wood parenchyma present. Vessel lines very coarse and consequently quite distinct to the naked eye. Rays of two sizes, fine and also very broad, causing a conspicuous marking on quarter-sawn stock. Ripple marks not present in the genus. Pith flecks not present.

Oak, American Red

Coarser in its appearance than English Oak, this timber is regarded as being less durable and inferior both to the closely related English and the American White Oak. It is the hardwood timber of *Quercus rubra*, and has the ring porous structure that is common to the *Quercus* group. The wood is rather lighter than most of the commercial Oaks, weighing on an average 38 to 48 lbs. to the cubic foot for fully seasoned stock. Straight grained, the texture is coarse and uneven, and the sapwood and the heartwood generally well defined, the sapwood being whitish or lightish and the heartwood reddish-brown; quarter-sawn timber has the characteristic Oak silver grain figuring. The working qualities approximate to those of English Oak, the timber being, if anything, rather harder than that species. Consignments of the wood are frequently offered for sale on the United Kingdom markets, and supplies would

seem to be readily available to meet all normal demands. See also studies of this wood by Hale and by McElhanney. American Red Oak is suitable for almost all the purposes listed for the preceding timber, and is satisfactory as regards its reaction to stain and polish finishes.

Macroscopic identification features of American Red Oak

See remarks on American White Oak, which also apply to this timber.

Oak, American White

American White Oak is a timber of southern Quebec, Southern Ontario, and various parts of the United States of America; as the tree is of tall growth habit the timber is obtainable in exceptionally large sizes. The wood is regarded as superior to American Red Oak as regards its durability, but is less satisfactory in this respect than English Oak. The working qualities of the wood approximate closely to those of other varieties of Oak, but this particular species does not fume well: in this latter respect the heartwood is less refractory than the sapwood which merely turns a patchy grey on exposure to the fumes of ammonia. American White Oak is the timber of *Quercus alba*, and has an average weight of 43-53 lbs. to the cubic foot. In colour the heartwood ranges from a creamy white to a pale brown, the heartwood and the sapwood not being well delimited. See notes on this timber by Hale, and by McElhanney.

The North American continent also provides other varieties of Oak that deserves mention. The Chestnut Oak which is included in the "white oak" group comes from the *Quercus montana*. It is light brown to pale brown in colour and is very similar to the White Oak in all its properties. Garry Oak (*Quercus garryana*) is also lighter in colour than most Oaks. It is a somewhat awkward timber to handle in seasoning treatments, and is more important locally than it is for export.

Macroscopic identification features of American White Oak

Being of the same genus as the English Oak, the macroscopic features are almost identical, though with the American species the rays are rather broader than they are with the English varieties.

Oak, Beef

This is an example of a mis-named timber for Beef Oak—the timber of *Grevillea striata*—has no affinity with the botanical family producing the true Oaks. It is an Australian timber that is the product of a tree of New South Wales and Queensland, and the wood has a purely local use for fencing posts, turnery, gates, fancy articles, and general utility purposes. It is a botanical hardwood, the heartwood of which ranges from red-brown to dark red-brown in colour, though the tint is uniform in any one specimen; the grain is irregular, the texture medium coarse and not uniform, and the average weight between 50 and 60 lbs. to the cubic foot. Beef Oak is a moderately easy timber to work by hand, turns well, and is reasonably resistant to the attack of wood-rotting fungi when used in exposed positions. The wood is not well known outside of the Australian continent, and there is no likelihood of a greatly increased demand for it. See literature regarding this timber by Baker and by Swain.

Other varieties of Australian Oak are provided by the *Casuarina* species. She Oak (*Casuarina stricta*) is normally available only in small dimensions, and it also suffers from the disadvantage of being rather difficult to work. The seasoning and the durability qualities are up to standard. The Swamp Oak is good as regards seasoning but is not easy to work. It is the product of *Casuarina suberosa*, and like the preceding species, is of little commercial importance. Honeysuckle Oak (*Banksia integrifolia* of the Proteaceæ family) is also used for cabinet making and allied purposes. It may be pinkish to a definite red in colour, average specimens weighing 35 lbs. to the cubic foot. Working qualities of this wood are not always satisfactory, and its durability is not rated highly. There is little likelihood of its being exploited on a big commercial scale.

Oak, Satin

Satin Oak is the hardwood timber of *Embothrium wickhami*, and botanically is very closely related to the very popular Australian Silky Oak (see below). Any fully seasoned specimen of the timber should weigh between 25 and 35 lbs. to the cubic foot, have a straight grain, and show a texture that is moderately

coarse and uneven. The heartwood of the timber is pinkish in colour, quarter-sawn stock having a silver grain figuring reminiscent of the *Quercus* species. Satin Oak is an easy timber to work, whether by hand or by machine, and the dulling effect on tools is so slight as to be negligible. The wood is naturally resistant to decay when used in positions unprotected from the weather or when placed in contact with the soil. It may be used for cabinet making, panelling, mouldings, and similar purposes, and it is also suitable for use as roofing shingles, though it is not a good structural timber. There is no likelihood of a big demand for the timber arising on the market apart from one that is purely local.

Oak, Silky

This, one of the most popular cabinet woods of Australian origin, is a reasonably durable hardwood timber, the sapwood of which is somewhat susceptible to powder-post beetle infestation. Kiln seasoned timber of the species is apt to cup rather badly (more especially with thin stock), and although the wood works easily under tools it is not always a simple matter to bring it to a good surface. Silky Oak is straight grained, but shows a coarse but uniform texture; the timber also turns well and bends satisfactorily. A certain amount of the timber is exported to this country, but it has to compete with woods of cheaper price and more ready availability. Silky Oak is the timber of *Cardwellia sublimis*, and when freshly felled is pink in colour, but with age and after exposure to the atmosphere it tones off to a pinkish brown; quarter-sawn stock has a prominent ray figuring that is reminiscent of the true Oaks, though it is not a member of that family. In Australia the supplies of this timber are probably more than sufficient to meet the normal demands. For a further study of the wood see Cox, and the standard writers on Australian timbers.

Oak, Tulip

This hardwood timber has a weight that may vary between 50 and 60 lbs. to the cubic foot for fully seasoned stock, a grain that may be either straight or shallowly interlocked, and a texture that is variable from medium coarse to coarse but uniform; it is the timber of *Tarrietia argyrodendron*. The

sapwood and the heartwood are usually well distinguished, the former being white to light brown in colour, and the latter dark brown, with radially sawn timbers showing a silver grain figuring. The timber may be marketed under the titles of "Red", "Brown" or "Blush Tulip Oak" according to the predominating hue, but there are no essential differences between them. The tree is not a member of the true Oak family, but timbers of large sizes are not uncommon. Tulip Oak is rather hard to work, but can be surfaced well; there is a tendency to brittleness and therefore the wood needs to be pre-bored for various operations. It is not naturally resistant to wood-rotting fungal attack, but it seasons well, though in the course of time it becomes very dry and brittle. For a full study of the timber the works of Baker and Swain, amongst others, may be studied with advantage.

Macroscopic identification features of Tulip Oak

Diffuse porous. Vessels medium in size; in short clusters or in short radial rows, the radial rows being the most common; simple perforations. Vessel lines conspicuous and distinct to the naked eye. Rays heterogeneous; visible to the naked eye; prominent on radial surfaces and distinct on tangential surfaces. Vasicentric and diffuse metatracheal types of wood parenchyma present, but the majority is in irregularly spaced metatracheal bands. Ripple marks present and distinct to the naked eye on tangential surfaces. Pith flecks not present.

Olive, European

This particular species of Olive (*Olea europea* of the natural order Oleaceæ) flourishes in the Mediterranean regions of Europe, being a low tree of a spreading growth habit, long life and slow growth. Economically it is more important for the olives and oil it produces than it is for its timber, though the latter may be used for carving, turnery, small fancy articles, novelties, and similar small items. The timber is not a naturally durable one for use in unprotected positions, but does not create any undue problems in seasoning, whether by natural or heat methods. It works well in all hand or machine processes, does not blunt tools unduly, and is an exceptionally good carving and turnery wood on account of

the firmness and closeness of the texture. The grain of the timber may be either straight or shallowly interlocked, the average weight being from 50 to 60 lbs. to the cubic foot, the heartwood of the species lightish-brown in colour, sometimes showing a greenish tinge, and with a slight striped figure on quarter-sawn surfaces. Botanically the timber is a hardwood.

Macroscopic identification features of European Olive

Diffuse porous. Growth rings distinct to the naked eye; narrow; boundaries indicated by darker bands that may have a line of terminal parenchyma in the middle. Vessels very small; usually visible under a lens; solitary, or in radial rows, the solitary vessels predominating; tyloses present; simple perforations. Vessel lines very fine. Rays heterogeneous; not visible to the naked eye but usually distinct under a lens; crystals not found in the ray parenchyma cells. Abundant paratracheal parenchyma, terminal parenchyma and abundant metatracheal parenchyma present; crystals are not seen in wood parenchyma cells. Ripple marks not present. Pith flecks not present.

Olive, Indian

This is the Indian species of Olive, and though the wood is of considerable importance in India it is not a factor of any note on the world markets. The wood is a naturally resistant one to the onset of wood-rotting fungal attack, and works well under most tool operations, though it may sometimes show a tendency to pick-up on the machine planer. Fine seasoning checks are frequently to be found in the converted timber of the species, although the wood cannot be said to be difficult to handle under seasoning processes. Local uses for Indian Olive include the making of tool handles, veneers, panelling, cabinet making, walking sticks, inlay work and turnery. The timber is the product of *Olea ferruginea*, and has an average weight that may vary between 63 and 68 lbs. to the cubic foot, the grain may be either straight or shallowly interlocked, whilst the grain is normally very fine and uniform. The sapwood and the heartwood are usually very sharply distinguished, the sapwood being whitish in colour whilst the heartwood is light brown to deep purple, sometimes figured

with darker bands of colour. Studies of the timber have been made by Pearson and Brown amongst other writers on Indian timbers.

Macroscopic identification features of Indian Olive

Conform very closely to those of the species previously described.

Padauk, Andaman

Andaman Padauk is a member of the Leguminosæ family, and is the timber of *Pterocarpus dalbergioides*, having an interlocked grain, and a texture that is variable but normally coarse; average timbers of the species weigh from 45 to 55 lbs. to the cubic foot when air dry. The sapwood and the heartwood are sharply delimited, the former being light in colour, whilst the heartwood may range from red-brown to warm red in shade, and may have red or black streaks. Andaman Padauk is not a difficult timber to season either in air or in a kiln and is better than the average as regards "movement" once that process has been completed. It is not an easy timber to work, has a definite dulling effect on tool edges, and is rather difficult to bring to a good surface, though it turns well and cuts satisfactorily for veneers. Converted timber of the species may be found to have suffered from wood-borer attack, but the timber is a naturally durable one for use in exposed positions. It is a very hard and strong wood of considerable commercial importance, and may be used for such items as turnery, veneering, piano cases, balustrades, interior fittings, furniture, parquet, panelling, and so on. Studies of the timber have been made by Howard, and by Pearson and Brown.

Macroscopic identification features of Andaman Padauk

Diffuse porous in structure. Growth rings quite distinct to the naked eye. Largest vessels clearly visible to the naked eye, others distinct under a lens; solitary, or in radial groups; open; simple perforation plates. Vessel lines distinct to the naked eye. Rays homogeneous; not visible to the naked eye. Abundant metatracheal type wood parenchyma present; paratracheal type of wood parenchyma also present. Ripple

marks present; not usually visible to the naked eye but distinct under a hand lens. Pith flecks not present.

Padauk, Burma

This timber (*Pterocarpus macrocarpus*) shows a less wide range of colour than does the preceding timber, and it is not as ornamental as Andaman Padauk. It is naturally durable for use in positions unprotected from the weather, and is especially resistant to white ant attack, and it is said to be difficult to impregnate with wood preservatives. The growing tree is often "girdled" as a pre-seasoning treatment, but during the drying operation surface checks are very likely to develop in the timber. The wood is rather harder to work than is Andaman Padauk, and, being brittle, it should be pre-bored before nailing or screwing. Burma Padauk turns well, and provided the grain is properly filled it is capable of taking a high polish. It is heavier than Andaman Padauk, averaging from 50 to 60 lbs. to the cubic foot, the grain is more deeply interlocked, and the texture is moderately coarse. The heartwood of the timber is yellowish to darkish-red when it is first felled, but later the wood tones down and becomes a uniform golden brown; quarter-sawn material has a narrow stripe figure. See studies of the timber as made by Cox, and by Pearson and Brown.

Macroscopic identification features of Burma Padauk

Almost identical with those of Andaman Padauk as detailed above.

Peach

The timber of *Persica vulgaris* comes from a slender tree of small growth habit, of more economic importance for its fruits than its timber, though the latter is suitable for certain minor uses, such as inlaying and marquetry. Being a member of the Rosaceæ it is closely related to the Almond, Plum and Cherry, and consequently its timber resembles that from the trees mentioned. The heartwood of the timber is reddish in shade, and has an average weight of 45 lbs. to the cubic foot when in an air dry state. The grain is somewhat variable, but it is fine and uniform in texture. Quarter-sawn stock has

a distinctive silver grain, and an attractive fragrance is also characteristic of the wood. Normal specimens of the timber are classed as difficult to work in all tool operations, but it will surface well, and its reactions to such treatments as staining and polishing are satisfactory. The natural rate of durability is not high, and it soon succumbs to decay if it is used under conditions that favour its development, though it is satisfactory where it is protected against the elements. No specific demand exists for the timber, nor is such a demand likely to arise.

Peach, Sierra Leone

This hardwood timber is of considerable local importance in various parts of tropical Africa, where it is normally used as a general utility timber. It is the product of a tree called *Sarcocephalus esculentus*. The timber has a weight that may vary between 35 and 40 lbs. to the cubic foot for fully air dried stock, the grain is normally straight, and the texture coarse but uniform; the colour of the heartwood is a yellowish tint. The wood is not naturally resistant to the ravages of wood-rotting fungi when used in positions exposed to the weather or if resting in contact with the soil, but it is sufficiently durable for internal use. When undergoing seasoning treatments the wood needs careful attention as it is liable to suffer sap-strain fungal infection, and cracking and splitting are by no means uncommon. The working qualities of the wood are quite good, and being a soft timber Sierra Leone Peach is highly suited for use as a carving wood; its response to decorative treatments is also said to be satisfactory. It is of very little importance from the general consumer's point of view and there is little, if any, likelihood of any greatly increased demand for the timber, except in its natural geographical area.

Pear

The timber from this well known tree (*Pyrus communis*) only reaches the market in small quantities, the tree being a native both of Europe and certain parts of Asia. It is a hardwood, has an average weight of 45 lbs. to the cubic foot, an irregular grain, but a fine and uniform texture. Heartwood and sapwood are not sharply distinguished, the wood being a light

reddish-brown in colour with no distinctive taste or fragrance. Pear is not a durable wood for use in unprotected positions, but is lasting for work under cover. It works well under most hand and machine processes, and may be given an excellent polish if so desired. The wood is only of limited use, but it may be employed for the making of certain types of drawing instruments (such as set-squares), and also finds use for inlaying, small fancy articles, and ornamental turnery. There is only a small demand for the wood; it is probable that supplies will be adequate to meet that demand for many years to come. For details of the anatomical structure of the wood, including a microphotograph of its transverse section, see Chalk and Rendle's work *British Hardwoods; their structure and identification*.

Macroscopic identification features of Pear

Diffuse porous in structure. Growth rings are variable as regards their distinctness, the boundaries being marked by bands of denser late wood. Vessels not visible to the naked eye, but visible under a hand lens; uniform distribution; mostly solitary. Vessel lines indistinct or not to be seen with the naked eye. Wood parenchyma not visible to the naked eye; not distinct under a hand lens; metatracheal in type. Rays fine; not distinct to the naked eye; usually visible under a hand lens, but not conspicuous on radial surface. Occasional pith flecks may be present, but ripple marks are not present in the genus.

Pine, Blue

Like all the true Pines this timber is an easy one to work, and finishes to a good surface; it will also hold glue, nails and screws satisfactorily, will turn well, and, if the grain is properly filled, may be satisfactorily polished. Blue Pine has low shrinkage factors, seasons with only a little degrade, and is reasonably stable once the drying process has been completed. Like all conifer timbers it is immune to powder-post beetle depredation, but it is only moderately resistant to decay, though it may be easily treated by wood preservative processes. If exposed to conditions favourable to its attack the wood may be infected by sap-stain fungi. The timber is suited for joinery and

similar softwood purposes, but is weak and consequently not suited for use as a structural timber. It is a straight grained, medium fine and even textured softwood with an average weight of from 25 to 35 lbs. to the cubic foot. The sapwood and the heartwood are readily distinguishable, the latter being a light pinkish-red with a slightly darker figuring. The wood is the timber of *Pinus excelsa*. For further details see Pearson and Brown, whose study includes a microphotograph of the wood.

Macroscopic identification features of Blue Pine

Growth rings distinct to the naked eye; boundaries marked by bands of denser late wood. The change from the early wood to the late wood is only gradual. Tracheids medium fine and show no sign of spiral thickening. Rays very fine and not distinct to the naked eye; unevenly distributed. Wood parenchyma not visible. Resin canals are not found in the wood.

Pine, British Honduras Pitch

British Honduras Pitch Pine may also be known as Slash Pine, Cuban Pine or Nicaraguan Pine. It is the timber of *Pinus cariboea*, has an average weight of 44 lbs. to the cubic foot, is straight grained, and has a fine and uniform texture. In colour the wood is yellowish-brown with a distinctive growth ring figuring, and it has both a resinous taste and smell. British Honduras, Central America, Cuba, and the south-eastern parts of the United States are the natural home of the tree producing this timber which is obtainable in large sizes. The wood is a naturally durable one that may, if desired, be successfully treated with wood preservatives. Thick stock seasons only slowly and may split whilst doing so, and thinner stock shows a tendency towards warping whilst drying; checking and splitting may also occur with the kiln seasoned timber of the species. The timber works fairly easily in all operations, but the tools must be kept well oiled to prevent clogging caused by the abnormally high resin content. Kiln-dried timber of the species in which the resin has set hard may be satisfactorily stained, varnished or painted; the wood also bends moderately well. For a further study of the wood see Cox; Record and Mell; Stone.

Pine, Brown

This softwood is one that really merits the adjective "soft" in its generally accepted sense as opposed to its botanical meaning. It is easy to work, whether by hand or by machine process, and its dulling effects on tools is so small as to be almost negligible; it finishes with a good clean surface and reacts in the general manner of the softwoods to all kinds of decorative treatment. Brown Pine may be summarized as a general utility softwood that is suitable for use for all purposes for which a low-grade conifer timber is fitted, and although it is considered in Australia to be one of the most important of the native softwoods it is not likely to be exported from there in any appreciable quantity. The wood may range from a pale brown to a darker brown in colour, and it has little distinctive figuring. Average specimens may weigh from 33 to 39 lbs. to the cubic foot inclusive, for fully seasoned stock. The grain is generally straight, and the texture fine and uniform. Brown Pine is the timber of *Podocarpus elata*.

Pine, Cypress

Cypress Pine is a naturally durable general utility softwood timber that is of considerable local importance wherever it may be found, but although the tree exists in commercial availability it does not reach the world markets in any appreciable quantity. The wood has a weight to the cubic foot that may range between 35 and 45 lbs. for average fully air dried specimens, and also has a moderately fine and uniform texture with a grain that is generally straight. The heartwood of the species is a lightish-yellow in colour, with a red or a brownish figuring, and there is rather a distinctive smell with the timber. Cypress Pine may be found somewhat difficult to surface cleanly owing to the number of knots usually found in it, and it needs pre-boring for nailing, screwing, mortising and similar operations as it is very apt to split, more especially when thin stock is being used. The timber is frequently used for piling and other under-water work as it has been found to be very resistant to teredo (ship-worm) and limnoria (ship-lice) attack. The wood is the product of *Callitris glauca*.

Pine, Hoop

Hoop Pine, sometimes called Moreton Bay Pine, is the timber of *Araucaria cunninghamii*, and has close botanical relatives in the fairly important Chile and Norfolk Island Pines. It is light in weight, averaging 34 lbs. to the cubic foot, has a straight grain, and a texture that is normally fine and uniform. The species ranges from pale brown to a light yellow brown in colour and may show pinkish or red tints; a distinctive smell, very similar to that of cheese, is present in the wood, but it has no noticeable taste. Hoop Pine has sometimes been described as the "only really good softwood of Australia", and is the product of a tree native to Queensland, New South Wales and New Guinea. It is not often to be seen on the general markets as the annual out-turn is almost entirely consumed in Australia. The timber has the normal properties of the true Pines in so far as regards its working, strength and durability. It is largely employed for such purposes as framings, mouldings, panelling and joinery, but in its country of origin it has also achieved importance for the manufacture of plywood and veneers. Studies of the wood have been made by the various writers on Australian timbers, and full details of the mechanical properties, etc., are to be found in the literature.

Macroscopic identification features of Hoop Pine

The growth rings are only normally just visible to the naked eye, and they are never quite distinct; the greater part of the growth ring is formed by the early wood, and the change to the late wood is only very gradual. The tracheids are irregular in outline and are not arranged in any definite formation. Rays are fine; are barely visible to the naked eye on the transverse section, but are usually distinct under a lens; they are not conspicuous on the radial surface; uniseriate. Resin deposits are quite common.

Pine, Jack

This is a somewhat knotty timber that is native to the North American continent, where it may be marketed under the alternative names of Banksian Pine or Princess Pine; it is a true Pine, being the timber of *Pinus banksiana*. The wood seasons well and does not warp or twist to any great extent,

hence the rate of seasoning degrade is low. It falls into the class of timbers described as the "hard Pines", and it is not noteworthy for its easy working qualities, though the grain is normally straight, and the texture moderately fine and uniform. Although by no means impermeable to wood preservative treatments, the timber needs incising to ensure of an adequate degree of penetration by the preserving fluid. Jack Pine has an average weight when fully air dry of between 25 and 35 lbs. to the cubic foot, whilst in colour the heartwood may range from pale brown to reddish-brown, showing a distinctive growth ring figuring. In Canada the timber is used for such purposes as railway sleepers, boxes, shuttering for concrete, and similar items, but the wood does not reach the general world market in any considerable quantity. See further notes on the timber by McElhanney.

Pine, Lodgepole

This timber cannot be regarded as commercially important when it is compared with many other of the *Pinus* species, but on the North American continent the wood finds considerable use for piling, mining timbers, railway sleepers, light structural timbers, and for work of a similar nature. The shrinkage factors of the wood are low and it seasons without undue distortion and with very little degrade. Lodgepole Pine is not a really hard timber to work in most processes, but on the other hand it may be more difficult to bring to a good surface on a planing machine than the majority of the Pines, owing to the prevalence of tight knots in the timber. The wood responds well to most types of decorative finishing treatment. Average air dry samples of the wood should weigh in the region of 29 lbs. to the cubic foot, and it should show a straight grain and a moderately fine and uniform texture. There is little differentiation between the heartwood and the sapwood of the species, the wood being a dull whitish in colour. Lodgepole Pine is the timber of *Pinus contorta*, and is sometimes called Black Pine or Western Jack Pine. McElhanney gives some notes on this timber.

Pine, New Zealand Kauri

For a softwood timber New Zealand Kauri Pine shows a marked resistance to the attacks of those fungi that cause

decay, but it is far less resistant to the depredations of termites or insects; like all the softwoods, it cannot (on account of its anatomical structure) be infested by the powder-post beetle group of pests. Considerable care in seasoning is necessary as the wood is very prone to warp while drying, thin stock being particularly refractory. New Zealand Kauri Pine has a high resin content and tools must be kept well oiled to prevent clogging, though the dulling effect on them is not very considerable. The tree has a commercial importance apart from its timber in that it exudes a gum that is of value in the making of varnishes. The wood is the timber of *Agathis australis*, and has an average weight of some 35 to 40 lbs. to the cubic foot. It is dark red-brown or yellowish in colour, with a distinctive growth ring figuring, and a lustrous surface; the grain is normally straight, with a fine and uniform texture. A closely-related timber coming from *Agathis dammara* provides the Dammar Pine, though this is of little commercial importance. The Queensland Kauri (see below) is another botanical relative.

Pine, Pitch

This very resinous, highly popular softwood timber finds considerable use in all parts of the world for such items as piling, ornamental joinery, school and church furniture, structural work, and many similar uses. It is the wood of *Pinus rigida*, and has an average weight of between 37 and 47 lbs. to the cubic foot when air dry. The grain is normally straight, with the texture fine and uniform. The wood is a darkish-yellow to a light reddish-brown in colour, with a prominent and distinctive figuring caused by the growth rings. Pitch Pine is not a difficult timber to work, whether by hand or by machine processes, and does not unduly blunt tools, but the resin content of the wood is so high that there is apt to be considerable clogging of hand tools unless the latter are kept well oiled. The shrinkage factors of the wood are on the high side, hence care must be taken in seasoning, and it is somewhat subject to warping, heart and cup shakes. The timber has the decided advantage that it is readily procurable in long lengths. The wood is in demand on all markets, but normally there is little difficulty in fulfilling orders.

Pine, Ponderosa

Ponderosa Pine is a soft and resinous Pine—the timber of *Pinus ponderosa*—that is a native of the regions round the Rocky Mountains. It is a reasonably durable timber for use in unfavourable situations, but the sapwood of the species is susceptible to various types of insect attack. Ponderosa Pine works well under all operations and finishes with a good clean surface; its reactions to finishing treatments are on a par with those of the other commercial softwoods. The seasoning qualities are good, and once the timber has dried out properly it is more stable than the average wood, an attribute that has made it popular for such purposes as pattern making or other work where freedom from “working” is essential. One defect that is commonly encountered in the converted stock is evidence of sap-stain fungal infection. The wood is light in weight, air dry material averaging 30 to 35 lbs. to the cubic foot, the grain is straight, and the texture usually fine and even; its colour is dark yellow to reddish-brown, with a distinctive growth ring figuring. See additional notes on the timber by McElhanney.

Pine, Queensland Kauri

This timber is yet another example of the true Pine family, being the wood of *Agathis robusta*, and consequently it has all the characteristics of the species. It is very light in weight, averaging between 25 and 30 lbs. to the cubic foot, has a straight grain, and a fine and uniform texture. The timber ranks as one of the most important of the Australian softwoods, but supplies are rarely available outside of that continent. It is not naturally resistant to the ravages of decay, but is, on account of its anatomical structure, immune to powder-post beetle attack. Queensland Kauri Pine is of the class of timbers known as the “soft Pines”, and works readily under tools in all hand or machine operations, finishing to a smooth, clean surface; it reacts well to the normal types of finishing treatment for a wood of its nature and use. The colour of the timber is fairly uniform in any given specimen, but it may range from a creamy white to a pale yellow or lustrous lightish-brown; the timber has no characteristic fragrance or taste. Cox, and Swain, are amongst the authors who have given studies of the wood.

Pine, Red

Red Pine may be offered for sale on the North American markets under the titles of Ottawa Red Pine, Canadian Red Pine, Norway Pine, or Quebec Red Pine. The timber is sometimes described as the North American equivalent to Baltic Redwood, and provides an exceedingly useful and commercially valuable timber. The texture is moderately coarse but uniform, the grain almost invariably straight, and the average weight something between 30 and 40 lbs. to the cubic foot. It has a broad sapwood that in colour is pale yellow or white tinged with yellow, whilst the heartwood is darker and may show a pale reddish tinge, whilst there is a pronounced colour difference between the early wood and the late wood. The timber—which comes from *Pinus resinosa*—has a faint but definite taste and smell of resin. Being a true member of the Pine family the wood is not naturally resistant to decay, but may be easily treated with wood preservatives. Red Pine is easy to work or carve, and finishes with a smooth lustrous surface, whilst it has the additional advantage that little twisting, warping, or checking of the timber occurs during seasoning. For literature dealing with Red Pine see Hale; McElhanney; Sargent.

Pine, Scotch

The Scotch Pine, also known as the Scotch Fir, is native to many parts of Europe, and is the best known and most popular home-grown species producing commercial timbers. The tree providing the wood (*Pinus sylvestris*) may grow to a height between 50 and 100 feet, overtopping that latter figure in favourable conditions, and may be felled for timber when it is between 50 and 60 years old. Timbers of good size are available, as the girth of the tree is not inconsiderable. For external work Scotch Pine is rather more durable than the average run of conifer timbers, but in general its other qualities are on a par with those of other *Pinus* species, and the wood may be used for much the same purposes. The timber has a reddish cast, with a distinctive figuring caused by the growth rings. Weight is variable according to the locality and nature of the soil in which the tree is grown, but the grain is normally straight and the texture reasonably fine and uni-

form. As far as this country is concerned, the best timber comes from the Highland forests, but these have been exploited very thoroughly, and supplies are less readily available than was formerly the case.

Pine, Western White

This North American Pine, the timber of *Pinus monticola*, produces a timber that is not at all refractory under drying treatments (either in air or kiln drying), and is one that gives little trouble as regards seasoning defects or other types of degrade, and once the drying process is finished it is more free from "movement" or "working" than is the average wood. It is classified as being only moderately durable when exposed to conditions that are favourable to termite attack or wood-rotting fungal development, but the wood responds well to preservative treatments. Typical uses for the timber include pattern making, joinery, panelling, toymaking, match splints, and most other uses to which a normal softwood may be put. The timber is not particularly heavy, air dry stock averaging between 23 and 33 lbs. to the cubic foot, and it is whitish in colour with a very indistinct growth ring figuring; the grain is normally straight and its texture fine and uniform. See additional notes on the timber by the standard writers on the North American woods.

Pine, White

White Pine is the timber of *Pinus strobus* and is sometimes given such alternative names as Eastern White Pine, American Yellow Pine, Quebec Pine, Yellow Pine or Weymouth Pine, and may reach the market under such titles. It is very light in weight, averaging only 20 to 28 lbs. to the cubic foot air dry, has a straight grain with a fine and uniform texture, and is whitish or a very pale yellow in colour, showing a very indistinct figuring. The timber seasons well and has very low shrinkage factors, making it an ideal wood for pattern making, whilst the tree producing it may grow to a height verging on 150 feet, the timber being free from knots and not very resinous. White Pine is susceptible both to sap-stain and wood-rotting fungal attack when exposed to conditions favouring their development, but it cannot be attacked by the powder-

post beetle group of pests. The timber works well under all tool processes, causing only a negligible amount of dulling of the tools, and it is an excellent timber for carving. It may be used for most of the normal softwood purposes, though being weak it is not a good structural wood and is mostly used for internal joinery.

Plane

This hardwood timber, often called Sycamore in England, is useful not only for furniture manufacture and cabinet making, but also as a structural wood. It is the product of a tree (*Platanus orientalis*) that may grow to a height of some 70 feet. The timber is hard, tough, and rather difficult to work, but it can be finished to a good clean surface. Plane is not a naturally durable timber for use in positions unprotected from the weather or in contact with the ground, but it is classified as durable for all purposes under cover. A certain amount of degrade may occur with the timber under seasoning processes, as it is very apt to warp badly. The grain of the timber is normally very irregular, but the texture fine and uniform, whilst the heartwood is either yellowish-white or brownish in colour. The weight of an average specimen will be found to be within the range of 35 to 45 lbs. to the cubic foot. See Chalk and Rendle for a full description of the structure, etc. Another Plane species, though only of local importance, is the *Platanus chiapensis*, which produces the Mexican Plane or Alamo. It resembles its better-known counterpart very closely. The so-called Cape Plane is also a hardwood, the timber of *Ochna arborea*, and although a good resilient timber it is only of local interest.

Macroscopic identification features of Plane

Definitely diffuse in structure. Growth rings reasonably distinct to the naked eye, and undulate slightly between the rays. Vessels are many but small; some solitary and others in tangential rows or groups; round in end-section; diffuse in distribution. Rays are of two sizes, many small and fine but the larger ones are quite distinct on the radial surfaces. Vessel lines are distinct to the naked eye. Ripple marks are not present in the genus.

Plum

The tree producing this timber—the *Prunus domestica*—is a common enough one, but is valued more for its fruits than for its timber, though the latter has a certain amount of use in the making of small fancy articles, novelties, parts of furniture, inlaying, and fine cabinet work. It is a hardwood timber with a weight that is between 35 and 45 lbs. to the cubic foot, is straight grained, and has a moderately fine and uniform texture. The sapwood of the timber is normally broad, whilst the heartwood is a deep brownish-red in colour. The seasoning qualities of the timber are quite satisfactory, and it works well under tools in all operations, providing an exceptionally good timber both for carving and for engraving. The demand for the wood is practically non-existent, and no difficulty should be found as regards future stocks. Another timber known as “Plum” is the Sapodilla Plum. This hardwood timber is not of the same botanical family as that producing the true Plum, but is a member of the Sapotaceæ. The tree (*Achras sapota*) flourishes in tropical America, and is one of the sources of “chicle” gum used for the manufacture of spearmint, whilst the bark of the tree also has certain medicinal properties. The greenish-coloured heartwood of the species is rated as very durable for use in exposed positions, and small quantities of it may reach the market under the description of Black Bully. The timber is of no commercial importance.

Poplar

Poplar, or Aspen, is a common tree of the temperate regions of the Northern hemisphere, being especially abundant in Europe and Siberia. The bark of the tree is rich in a bitter alkaloid called “salacin”, and the timber of Poplar (which is a hardwood) is produced by various species of *Populus*. The wood is only moderately durable for use in unprotected positions, and is difficult to impregnate with wood preservatives. Poplar is an awkward timber to handle under seasoning treatments, being apt to warp and twist as it is drying out, but being soft it is easy to work or carve, and it finishes with a clean, smooth, but non-lustrous surface. The wood of Poplar (which is frequently mistaken for that of Willow) reacts well to the normal types of finishing treatment for a timber of its class. It has an

average weight of 25 to 35 lbs. to the cubic foot, a straight grain, and a fine and uniform texture. The heartwood and the sapwood of the timber are not well defined, the wood being yellowish to a brownish-white in colour. For details of the anatomical structure and a microphotograph of the wood see Chalk and Rendle.

Macroscopic identification features of Poplar

Diffuse porous in structure. Growth rings quite distinct to the naked eye. The vessels are many in number; small in size and not always distinct even under a hand lens; gum deposits are frequently present. Vessel lines, etc., cannot normally be seen with the help of a hand lens, and in view of its similarity to other timbers, positive identification is best made on microscopic and not macroscopic features.

Poplar, Canadian

Canadian Poplar is the timber of a small to medium sized tree that may reach an age of 200 years, and one that is widely distributed in Canada and the northern United States of America, the tree being the *Populus canadensis*. It is a straight grained, fine and uniformly textured hardwood timber, lightish or pale yellow in colour, and having an average weight of between 25 and 30 lbs. to the cubic foot. The timber is only a moderately durable one for use in unprotected positions, and cannot be easily treated with wood preservatives. Under seasoning treatments the wood may warp or twist considerably, resulting in a high rate of degrade, but it works easily under either hand or machine processes, and the dulling effect on tools is not great; it carves and turns well, and will take stain or other types of finishing agent satisfactorily. Canadian Poplar is not a strong timber and is not suited for structural work, but it is a good general utility wood. For further details of the wood and its properties and uses, see McElhanney, but in general the wood closely resembles the European species dealt with above.

Macroscopic identification features of Canadian Poplar

See the remarks under Poplar above, which are also applicable to this timber, which is of the same genus.

Purpleheart

Purpleheart may reach the market under the title of Amaranth, and in the American trade is frequently described as Violetwood. It is the hardwood timber of various species of *Peltogyne* of the Leguminosæ family, and is a heavy timber, air dry specimens of which weigh between 60 and 65 lbs. to the cubic foot. The grain may be either straight or wavy, but the texture is almost invariably fine and uniform. Sapwood and heartwood of the timber are well distinguished, the sapwood either whitish or streaked with purple, whilst the heartwood has a uniform purple tint. The timber reaches the world markets in small quantities of small dimensions, though the bulk of the available supply goes to the American trade. It is not a difficult timber to work in any process, turns well, and can be finished to a good clean surface. Purpleheart is not of the class of timbers normally given preservative treatments, and its natural durability stands quite high. Its outstanding quality is its ability to withstand sudden shocks, hence the wood is particularly well suited for such work as vehicle construction and the making of spokes, etc. Available supplies of the timber are sufficient to meet the normal demands. See study of the wood by Record and Mell.

Macroscopic identification features of Purpleheart

Definitely diffuse porous in structure. Growth rings are not normally distinct to the naked eye, but in some rare cases may be quite distinct. Vessels small to medium-sized; not always visible to the naked eye; solitary, or in occasional radial pairs; simple perforation plates. Vessel lines normally not conspicuous but visible to the naked eye. Rays fine; visible on transverse section; invisible on tangential surfaces and distinct to the naked eye on radial surfaces. The wood parenchyma is aliform in type, with a tendency to become confluent. Ripple marks are not present in the genus. Pith flecks are not present.

Pyinma

Pyinma is a timber of Burma and adjacent parts of India that is not well known on the world markets but which is held in good esteem locally. Pyinma (also known as Jarul)

is the timber of *Lagerstroemia flos-reginae*, a botanical hardwood. The wood has an average weight ranging from 35 to 45 lbs. to the cubic foot, is straight grained, with the texture medium coarse but uniform; the heartwood of the species is a pale red-brown in colour. Pyinma is a general utility timber that may be used for turnery, though selected material is suitable for panelling and similar purposes. The timber is not a naturally resistant one when exposed to the onset of wood-rotting fungi, and is a difficult timber to treat with preservatives, even by pressure processes. Pyinma works well under tools in all hand or machine processes, and responds well to most types of finishing treatment. See also studies of the wood by Pearson and Brown. A closely related botanical species is the Indian Benteak, a brief study of which has been given under that title above.

Raspberry Jam

This is a hardwood timber of Western Australia that is known by name only to the majority of timber users, and is one that has a purely local importance, though even this is not particularly great. It is the timber of *Acacia acuminata*, having a heartwood that is dark brown to a darkish red-brown in colour, whilst quarter-sawn timber may show a striped figure, owing to the grain, which is normally interlocked. The texture of the wood is fine and uniform, and it has a distinctive smell that has been responsible for its name; the average weight of air dried timber of the species is between 55 and 65 lbs. to the cubic foot. Raspberry Jam is rather a difficult timber to work and is, therefore, frequently used in the form of round barked poles. It is hard and durable, but has few, if any, outstanding properties that are likely to bring it into popular demand. The wood may be used for fencing posts and for general external work. There is little essential difference between this and the other Australian species of *Acacia*, of which Australian Blackwood may be taken as an example.

Redwood

Redwood, also known as Sequoia Pine or Californian Redwood, is a softwood, and the timber of *Sequoia sempervirens*. The average weight of the timber is from 35 to 45 lbs. to the

cubic foot, the grain is straight, and the texture moderately fine and uniform. The heartwood of the timber is reddish in colour, with a distinctive figuring, but the wood has no characteristic taste or smell. Redwood provides one of the best known softwoods in the world. The tree providing the timber (specimens of which are known to have reached an age in excess of 2,000 years) flourish on the Pacific Coast and may grow to an immense height, one tree in the famous "Redwood Park" in California being just over 365 feet high, and with a tremendous girth. The timber is easy to work, whether by hand or by machine tools, but is rather brittle and is of the class of timbers needing pre-boring for certain operations. Redwood is not a naturally durable timber except for use in positions protected against the weather, but it may be used for most of the normal softwood purposes. For further particulars regarding the timber see, amongst others, Howard; Sargent; Stone; Winn.

Redwood, Baltic

Baltic Redwood has the alternative names of Northern Pine, Scotch Fir or Scots Pine, but is best known on the market under the name of Red or Yellow Deal. It is a softwood timber with an average weight of about 35 lbs. to the cubic foot when it is in an air dry state. The wood is straight grained, with a fine and uniform texture, and a heartwood that is either reddish or yellowish in colour, with a distinctive growth ring figuring; it is the timber of *Pinus sylvestris*. The tree producing the wood is of quick growth and is native to various parts of Europe and Asia, being the only *Pinus* species indigenous to Great Britain. For a softwood the timber is reasonably durable and it is not difficult to work. Its seasoning qualities are good, and there is little warping or shaking during the drying process. Typical uses for the wood include internal and external joinery of all types, floorings, matchings, sleepers, poles, fencing, and structural work. The tree also yields turpentine. The name Baltic Redwood is normally confined to those trees grown on the Continent, with the name Scotch Pine, given to our native home-grown species.

Rimu

Rimu, which may also be offered for sale under the title of New Zealand Red Pine, is the timber of *Dacrydium cupressinum*, a tree that is indigenous to New Zealand, and one that may grow to a height verging close on 100 feet, thereby providing timbers of good dimensions. When it is freshly felled the straight grained timber has a reddish-brown tint, but with age and exposure to the atmosphere this fades to a lightish-brown, and it shows a distinctive figuring made up of dark and light streaks. The timber is easy to work under all hand and machine tool processes, but not being naturally resistant to decay and insects it is not often used out of doors, hence it is chiefly used for such items as panelling, flooring, and interior fittings. Small quantities of the timber have been imported into this country from time to time, but it is not of any great importance to our markets, though it is one of the most highly esteemed of the timbers native to New Zealand. Additional details of Rimu are given in *A Handbook of Empire Timbers*, edited by Cox.

Rosewood, Brazilian

This timber has been steadily marketed over a period of centuries, and supplies are now far less readily available than was the case even a few years ago. The wood is the product of a tall but slender tree (*Dalbergia nigra*) of tropical America, producing long but relatively narrow boards. Although chiefly used under cover the timber is a naturally durable one, and works easily, though having a rather high oil content, the wood will not always polish satisfactorily. The average run of air dry timbers weigh between 50 and 60 lbs. to the cubic foot, the growth is normally straight, but in some specimens may be wavy, and the texture is almost invariably medium coarse. Sapwood and heartwood are very sharply distinguished, the sapwood being almost colourless or lightish, with a heartwood ranging from chocolate to a very deep brown; the timber has a distinctive mild fragrance, and a faint taste. Typical uses for Brazilian Rosewood (which may also be called Jacaranda, though this is more in the nature of a local name) include cabinet making, panelling, furniture, piano cases, and handles for certain types of tools and instru-

ments. Brazilian Rosewood may be summarized as being a first-class, highly important decorative cabinet timber. See literature by Howard, and also by Record and Mell.

Macroscopic identification features of Brazilian Rosewood

Diffuse porous in structure. Growth rings may not always be visible but at other times are quite distinct to the naked eye; boundaries indicated by lines of terminal parenchyma. Vessels mostly large, and not very numerous; mostly open, but gum deposits may be present; simple perforation plates. Vessel lines are distinct to the naked eye, but not particularly prominent. Rays very fine; homogeneous; not visible to the naked eye. The wood parenchyma is often poorly marked, though the terminal parenchyma may sometimes be quite clearly seen. Ripple marks are present and are sometimes seen without the aid of a lens. Pith flecks are not present.

Rosewood, Honduras

Honduras Rosewood, the hardwood timber of *Dalbergia stevensonii*, is heavy in weight, averaging about 63 lbs. to the cubic foot, air dry, normally has a straight grain, and the texture is uniform but rather coarse. Sapwood and heartwood are sharply delimited, the sapwood greyish in colour, and the heartwood ranging from dull brown to almost purple, with a figuring of darker lines or streaks; the wood has no taste, but has a mild and distinctive smell. It is a durable timber coming from a tree that reaches its best development in the coastal region of British Honduras. Under seasoning treatments it may prove somewhat refractory to handle, though the wood shows a high degree of stability once the drying process has been completed. It is not a difficult timber to treat with tools, and surfaces well; it turns nicely, but very oily specimens create difficulty in polishing. Honduras Rosewood may be summed up as a slightly ornamental cabinet timber of more than local importance, and one with which some difficulty may be encountered later in fulfilling demands. See studies of the wood as made by Cox; Record and Mell; Stone. The timber is closely related to the Brazilian Rosewood, and therefore their properties are very similar.

Macroscopic identification features of Honduras Rosewood

Of the same genus as the Brazilian Rosewood, and consequently shows the same characteristics.

Rosewood, Indian

The timber comes from a large tree of slow growth habit that is widely distributed over India. It gives little trouble whilst seasoning, and selected stock is one of the most attractive woods that can be used for furniture of all types, and cabinet making. It is a naturally durable timber when used in unprotected positions and has earned a good reputation for durability under water, though these properties are not of importance in view of the purpose for which it is used. Indian Rosewood is not an easy timber to work under hand or machine tools, but it turns and carves well, and may be brought to a good smooth surface; it responds well to finishing treatments and also polishes satisfactorily, as its oil content is not as high as that of the other commercial Rosewoods. Cox, and Pearson and Brown have made studies of the timber, which normally weighs between 50 and 60 lbs. to the cubic foot. In average timbers the sapwood is yellowish in colour, and the heartwood dull brown to almost purple, with a darker figuring; fresh sawn timbers have the characteristic fragrance of the species. Indian Rosewood is the timber of *Dalbergia latifolia*, and may be sold under the title of Bombay Blackwood.

Macroscopic identification features of Indian Rosewood

Similar to those of Brazilian Rosewood, being of the same genus.

Sal

This ranks as one of the most important commercial hardwood timbers native to India, and is the product of *Shorea robusta*, being thus related to the Lauans and Meranti (see above), and the timber has much in common with them. In weight the wood comes within the 50 to 60 lbs. to the cubic foot range, when in an air dry condition, the grain is interlocked and the texture medium coarse. The heartwood of the species is a dark red-brown in colour, and quarter-sawn stock may show a striped figuring. The wood has a rather large number of resin canals in its structure, and these

may result in splits during seasoning, an operation in which the wood also shows a tendency to warp. Sal is a very strong timber and one that is eminently suited for use for structural purposes, and also finds employment for flooring, bridging, and similar work. It is not an easy timber to work by hand, but does not cause trouble in machining. It is of local importance only, and is not likely to become an important factor on the world markets. See literature on the subject by Pearson and Brown.

Sandalwood

The tree producing this timber is a native of the East Indies and extends as far south as Australia, but the trees have been exploited so freely in the past that supplies are now tending to diminish yearly. It is a slow drying timber, and is one that causes no problems in seasoning. Sandalwood is naturally resistant to the ravages of decay but is used more for making cabinets and purposes where the good fragrance is an asset than it is for work where its durability is likely to be of importance; it is also important as an incense wood, and for the extraction of Sandalwood Oil used medicinally and in perfumes. It is an easy working timber, and one that carves and turns well. Sandalwood is provided by *Santalum album* of the Santalaceæ family, and may average anything between 55 and 65 lbs. to the cubic foot. The grain is either straight or wavy, and the texture very fine and uniform; the heartwood of the species is yellowish-brown, deepening after exposure to the atmosphere to a dark reddish-brown; the wood has a strong distinctive smell. Further details of Sandalwood are given by Howard; Pearson and Brown.

Macroscopic identification features of Sandalwood

Definite diffuse porous structure. Growth rings are not always distinct to the naked eye, but may be so in some instances. Vessels very small or small in size, but are visible under a hand lens; mostly solitary in their arrangement; occasional tyloses are present; brownish gum deposits common; simple perforation plates. Vessel lines fine. Rays heterogeneous; very fine; not visible to the naked eye but have a definite flecking effect on quarter-sawn stock; crystal deposits

are not found in the ray parenchyma. Scanty paratracheal type of wood parenchyma present with abundant metatracheal parenchyma. Ripple marks not present in the genus. Pith flecks not present.

Sandalwood, Australian

Three different species of *Santalum* go to make up Australian Sandalwood, these being *Santalum lanceolatum*, *Santalum cygnorum* and *Santalum preissianum*, their natural habitat being Queensland, Western and Southern Australia respectively, but they may all be marketed together with *Santalum album* (the best known Sandalwood, see above) under the general name of Sandalwood. The wood has an average air dry weight of from 45 to 55 lbs. to the cubic foot, a straight or a wavy grain, and a very fine and uniform texture, the heartwood being yellowish in colour and the timber having the distinctive Sandalwood smell. A considerable export trade is done in this timber from Australia to China, where the wood is prized for joss-sticks and for funeral "furniture" buried or burned in or near relative's graves. The tree also yields an oil with a certain commercial importance. Its uses as a timber are confined to turnery, carving, inlaying, fancy articles, and so on, but the wood is not readily obtainable, even on the Australian market. Studies of the wood (which may also be called Queensland Sandalwood) are included in works by Baker and by Swain.

Macroscopic identification features of Australian Sandalwood

Being a true Sandalwood this timber has the same macroscopic identification features as those listed under the previous entry.

Sandalwood, Red

Red Sandalwood may also be known as Red Sanders Wood or Caliatour Wood, and is the hardwood timber of *Pterocarpus santalinus*, having an average weight of 60 to 65 lbs. to the cubic foot when fully seasoned, a shallowly interlocked grain, and a medium fine and uniform texture. In the heartwood the timber is very dark to almost black in colour, with a figuring of darker streaks in the lighter varieties; radially sawn material may have a narrow stripe figuring caused by

the interlocked grain. Red Sandalwood is a naturally durable timber as regards wood-rotting fungal or white ant attack. It is not an easy timber to work, whether with hand or with machine tools, but it can be brought to a good clean surface, and it carves and polishes satisfactorily. In addition to its use as a timber the tree also has medicinal properties and yields a useful dye. The wood is of the same genus as that producing the Padauks, but it is neither as well known nor as popular as these timbers, nor is it likely to become so.

Macroscopic identification features of Red Sandalwood

See the entries under Padauk above, the macroscopic features being very similar.

Sandalwood, West Indian

This timber is the product of a tree growing in tropical America, and reaching its best development in Venezuela. The tree (*Amyris balsamifera*) is not well known as a source of timber, and its commercial importance rests principally on the fact that it yields West Indian Sandalwood Oil, that finds considerable use for medicinal and other purposes. The timber would probably be useful for such secondary items as inlaying, marquetry, turnery and small fancy articles, but with so many better known and more easily available timbers already on the market, no special demand is likely to arise for it. Normally the timber is a straight grained wood, and has a fine and uniform texture with an average weight that is in the region of 66 lbs. to the cubic foot for seasoned stock. The thin sapwood is whitish, whilst the heartwood is either yellowish or brownish in shade after it has been exposed to the atmosphere; the timber has a spicy taste and a distinctive unpleasant smell. The wood may be sold as Amyris Wood or Venezuelan Sandalwood. For a further study of the wood see the full details as given by Record and Mell.

Sapele

Sapele (also spelt sapeli) may be sold under the title of Sapele Mahogany, and is the timber of *Enthondrapragma cylindricum*. It is a hardwood, showing an average weight of 35 to 45 lbs. to the cubic foot, air dry, a straight, interlocked

or wavy grain, and a moderately fine and uniform texture. When freshly felled it is pink in colour, but darkens after exposure to the atmosphere to a purplish-brown or dark reddish-brown, has a characteristic smell that is reminiscent of the Cedars, whilst radially sawn timber may show a striped figuring if interlocked grain is present. The timber comes from a West African tree that may reach a height in excess of 150 feet. It is not an easy timber to season, and may warp considerably during the drying process, but it works well under tools. Sapele is classified as moderately durable for external use, but is chiefly employed for work in protected positions; the wood peels well for veneers, and polishes satisfactorily. It may be used for such purposes as furniture making, veneers, shop and ship fittings, cabinet making and high-class joinery.

Sassafras

In many respects this tree is valued more for its by-products than its timber, as from it comes bark and root beer, patent medicines, and an essential oil that is the source of artificial heliotrope used in perfumery and the manufacture of cosmetics. The timber is refractory under seasoning treatments and is subject both to insect and fungal attack. In all hand and machine processes the wood works well, with no undue dulling of tools. It is a hardwood, coming from *Sassafras variifolium*, with a lightish to light red-brown coloured heartwood, a moderately coarse and uneven texture, and a grain that is generally straight. The wood is quite light in weight, having a range from 25 to 35 lbs. to the cubic foot, has a characteristic strong but pleasant smell, and is one of the relatively few timbers that show a ring porous structure. A considerable quantity of the wood reaches the market in the form of small chips for use in the dyeing industry. Two other species known as Sassafras are the Yellow Sassafras (also known locally as Golden Deal), the hardwood timber of *Dryophora sassafras*, native to Queensland and New South Wales, and the Tasmanian Sassafras (*Atherosperma moschatum*). Both timbers are, in general, of good properties, but of purely local importance.

Satinay

Satinay is the timber of *Syncarpia hillii*, a hardwood species. It has an average weight of from 50 to 60 lbs. to the cubic foot for air dry material, an interlocked grain, a fine and uniform texture, and a heartwood that is reddish to reddish-brown in colour; quarter-sawn stock may have a striped figuring. It is a moderately hard, moderately durable timber that is the product of a tree native to the Australian continent that reaches its best development on Fraser Island, off the coast of Queensland. The timber is said to have received its name because of its resemblance to the so-called "satine" timbers of tropical America. The wood is of importance in Australia only, and although sufficient quantities of the timber probably exist to meet all requirements that may arise, a greatly increased demand is very unlikely. Satinay may be used for panelling, cabinet making, veneering and structural purposes. See notes on the timber made by Baker and by other Australian writers.

Satinwood, East Indian

The finest timber of this species comes from Ceylon, and the wood is well known and popular on the world markets, where it may be offered for sale under the description of Ceylon Satinwood, Flowered Satinwood, or Satinwood. It is a hardwood timber (the product of *Chloroxylon swietenia*), and has an average weight range of 50 to 60 lbs. to the cubic foot, a narrowly interlocked grain, and a fine and uniform texture. The heartwood is light or golden yellow in colour, quarter-sawn stock showing a narrow stripe figuring, and has a lustrous surface. The timber is a naturally durable one when used in exposed positions, but is regarded as a cabinet wood, not being used externally to any great extent; it is classified as difficult to impregnate with wood preservatives. Seasoning defects are quite common, and it is not an easy timber to work, though it can be brought to a good clean surface; its turning and carving qualities are good, as is its response to finishing treatments. Amongst the typical uses to which the timber may be put can be mentioned cabinet making, turnery, small fancy articles, carving, panelling, furniture, etc. See notes on the timber by Cox.

Macroscopic identification features of East Indian Satinwood

Definitely diffuse porous in structure. The growth rings are distinct to the naked eye, and have their boundaries marked by thin lines of terminal parenchyma and the smaller late wood vessels. Vessels are small, but distinct under a hand lens; solitary, and also in radial rows, the radial rows outnumbering the solitary vessels; open, or filled with gum deposits; tyloses are not present; simple perforations. Vessel lines not visible except with the help of a lens. Rays homogeneous; not visible to the naked eye. Sparse paratracheal and metatracheal types of parenchyma present; terminal parenchyma also present and quite distinct to the naked eye. Ripple marks are present in the genus and are regular, but scarcely visible to the naked eye. Pith flecks are not present.

Satinwood, West Indian

West Indian Satinwood is quite well known on the general world markets, and is the product of trees whose natural home is in Bermuda, Southern Florida, and the West Indies generally. It is not resistant to the attack of wood-rotting fungi in exposed positions, and finds its greatest use for internal work. It handles well, whilst under either hand or machine tools, and also turns satisfactorily, but for a cabinet timber it suffers from the disadvantage that it has a high oil content, and polishing processes do not always produce satisfactory results. The wood is the product of *Zanthoxylon flavuum*, and may weigh between 50 and 60 lbs. to the cubic foot. The grain is irregular, but the texture fine and uniform, the heartwood of the species being yellowish in colour, darkening into tint after prolonged exposure to the atmosphere. West Indian Satinwood has a characteristic taste and a distinctive smell of coconut oil. It may reach the market under the title of Harewood or Concha Satinwood. Further notes on the timber may be obtained from the works of Cox; Howard; Record and Mell; Stone.

Macroscopic identification features of West Indian Satinwood

Diffuse porous in structure. The growth rings are quite distinct to the naked eye. Vessels are small; numerous; not distinct to the naked eye but usually distinct under a hand lens; solitary, or in small radial groups; open, or gum deposits may

be present; simple perforations. Vessel lines fine; not generally distinct except under a hand lens. Rays are mostly homogeneous; just visible to the naked eye on tangential surfaces; distinct to the naked eye on transverse section; not particularly conspicuous on radial surface. Ripple marks not present in the genus. Pith flecks not present.

Snakewood

Snakewood is also called Letter Wood, Leopard Wood or Tortoiseshell Wood, and is the hardwood timber of *Piratinera guianensis*. It is very heavy, having an average weight in the region of 80 lbs. to the cubic foot, air dry, has a straight grain, a fine and uniform texture, and a heartwood that is dark red or reddish-brown in colour, with darker markings resembling a snake skin. Only the heartwood of this tropical American timber is of any commercial use, but the timber provides one of the heaviest of the tropical woods. The tree itself may grow to a height in excess of 100 feet, the bark of it being found to be rich in latex. Unlike most timbers Snakewood is sold by weight as opposed to the shipping ton, and is barked and freed of sapwood before export. The timber is rather difficult to work with hand tools, and is somewhat brittle, needing pre-boring for nailing, mortising, etc. The timber slices well for veneers, and reacts satisfactorily to the usual types of finishing treatment given to a timber of its class, polishing exceptionally well. For a detailed study of the wood and its anatomical structure see Record and Mell. Another timber known as Snakewood comes from the *Strychnos nux-vomica*, also known as the Strychnine Tree or Nux-Vomica. The tree yields strychnine and is of considerably more medicinal than timber importance, though the wood has a bitter taste that renders it immune to termite attack, though it is not a naturally durable timber where fungi attack is possible. Average specimens weigh from 50 to 60 lbs. to the cubic foot, have a heartwood that shows a distinct yellowish tinge, and possesses a fine and uniform texture. As a timber it is only of very rare use, and its economic importance is negligible.

Macroscopic identification features of Snakewood

Diffuse porous in structure. Growth rings not visible. Vessels very small, but normally to be seen with the naked

eye; mostly solitary, but also in small groups; tyloses abundant; simple perforations; calcium oxalate deposits quite common. Vessel lines are not conspicuous. Rays are very fine; invisible on the tangential surface and only barely visible on the radial surface and the transverse section. Wood parenchyma is not conspicuous; aliform, and sometimes confluent type. Ripple marks not present in the genus. Pith flecks not present.

Sneezewood

This hard and strong timber is a member of the same botanical family as that producing the true Mahoganies, but the wood is used for very different purposes. Its principal uses are for fencing posts, piling, poles, and other external work where its great power of resistance to decay will stand it in good stead. It is a hardwood, and is the product of *Ptaeroxylon obliquum*, having a distinctive smell that is strongly reminiscent of pepper. Average timbers are irregularly grained and coarse and unevenly textured, weigh between 55 and 65 lbs. to the cubic foot in an air dry state, and, when freshly felled, have a bright red heartwood that later tones down to a brownish tint. It is not a difficult timber to season whether in air or by kiln treatment, but is rather awkward to handle under tools as the sawdust has irritant properties and causes considerable sneezing whilst the wood is being worked. Sneezewood is of the class of timbers that need pre-boring before nailing, screwing, or similar operations, and, having a high oil content, it does not always glue well.

Spruce, Canadian

This is the North American equivalent to the Norway Spruce or Fir of Europe, and if its use in the paper making industry and allied trades is taken into account, must probably rank as the most important commercial timber of Canada. Also known as White Spruce, it is the timber of *Picea glauca*, is light in weight (averaging between 23 and 33 lbs. to the cubic foot) with a straight grain and a fine and uniform texture. The heartwood and the sapwood of the species are not sharply delimited, the wood being pale yellow or lightish in colour. Although the shrinkage factors are on the high side the timber seasons easily, and with only little distortion. The wood works

easily in all operations, has little dulling effect on tools, but is rated as only moderately durable for work in exposed positions. It is resilient, but is not much used for structural purposes. Typical uses for the timber include sounding boards for musical instruments, food containers, ladders, shop fittings, oars, shuttering for concrete work, agricultural implements, kitchen cabinets, canoe building, paper pulp and similar items. Hale, McElhanney and Sargent are amongst the authors who have contributed studies and notes on the wood. In addition to the two important species listed below, the *Picea mariana* and the *Picea rubra* provide the Canadian Black and Red varieties of Spruce respectively. These are not normally marketed as separate timbers, and in all their qualities closely resemble the *Picea glauca*.

Spruce, Engelmann

This timber, which closely resembles the other North American Spruces in its attributes, is the product of a tree (*Picea engelmannii*) native to the Rocky Mountain regions. The tree grows to a considerable height and boards of good sizes reasonably free from blemishes are readily obtained on the American market. It is not a naturally durable wood, though immune to powder-post beetle attack on account of its anatomical structure, and as the shrinkage factors of it are on the high side, care is needed in seasoning if the percentage rate of degrade is to be kept reasonably low. Typical uses for Engelmann Spruce include the making of food containers, planking, sounding boards for musical instruments, and light structural work. It is rather light in weight, average air dry timbers weighing between 25 and 30 lbs. to the cubic foot, the grain is normally straight, and the texture fine and uniform. It is whitish or lightish yellow in colour, and is without any characteristic taste or smell. The timber is sometimes sold under the name of Western Spruce, or may merely be marketed with other species as Spruce. For further details of the wood see the authors listed under the preceding entry.

Spruce, Himalayan

The softwood timber of *Picea morinda* has a weight of between 25 and 35 lbs. to the cubic foot, a straight grain, and a fine and uniform texture, being brownish in colour in the heartwood.

The timber ranks as being one of the most important of the softwoods native to India, where it is used for such purposes as planking, water troughs, packing cases, and other uses for which a cheap-grade softwood may be employed. It is normally an easy timber to work under all processes, but some specimens are found to be rather knotty and may cause a certain amount of trouble in machine planing. Himalayan Spruce is moderately durable for external use, not resistant to white ant attack, and is not easy to treat with preserving agents; like all the softwoods it is immune to powder-post beetle infestation. To obtain a better degree of penetration of preservative fluids with this timber it is often incised by being passed through studded rollers. It is, of course, a close botanical relative to the other true Spruces, and exhaustive tests of its mechanical properties and so on have been made in India. The results of such tests can be studied in the works of standard writers on Indian timbers.

Spruce, Sitka

An average specimen of Sitka Spruce weighs slightly heavier (23 to 32 lbs. to the cubic foot) than does ordinary Canadian Spruce, but in all other respects it conforms closely to that wood. It is the timber of *Picea sitchensis*, and has the alternative names of Silver Spruce and Coast Spruce. The timber is straight grained, fine and uniformly textured, and in colour is a creamy white with a pale pinkish tinge, the heartwood and the sapwood of the species not being well distinguished. Sitka Spruce is only moderately resistant to the attacks of wood-rotting fungi, and is somewhat subject to sap-stain fungal infection, though in common with all the other softwood timbers it is immune to powder-post beetle infestation. The timber dries out well under seasoning processes (both air and kiln) and does so with only a low rate of degrade. It works very well under tools, finishing to a smooth surface, and responds satisfactorily to the normal decorative finishing treatments for a timber of its class. Sitka Spruce may be used for all the normal softwood purposes; see literature by the same authors as those quoted in the remarks on Canadian Spruce above, both for details of the tree and its timber.

Stinkwood

Stinkwood, or Cape Laurel as it is alternatively known, is the hardwood timber provided by *Ocotea bullata*. The heartwood of the timber ranges from pale yellow through shades of brown to almost black in colour, sometimes showing a striped figure on quarter-sawn surfaces. The grain is interlocked and the texture reasonably fine and uniform, whilst the average weight of a cubic foot of the air dry timber of the species is between 45 and 55 lbs.; the characteristic unpleasant smell that has given the wood its name is not discernible in the fully seasoned timber, and is therefore no great drawback. It is a tough and strong wood that has long been well known for its beautiful and distinctive figuring, but supplies are not now as readily available as was the case formerly, and with the demand greater than the possible supply, the timber commands a high price. Stinkwood is a difficult timber to season, and degrade during that process may be high. It is not an easy wood to work but good results can be obtained if the cutting edges of tools are kept sharp. The wood is used only for such purposes as high-grade furniture, panelling, ornamental turnery, and similar items.

Stoolwood

Stoolwood is a hardwood timber of purely local importance, and is the product of *Alstonia congensis*, a tree native to various regions of East Africa. It is of light weight, averaging only between 25 and 30 lbs. to the cubic foot when seasoned. The wood has a straight grain, is reasonably fine and evenly textured, and in colour is a pale yellow. Stoolwood seasons well and with only a moderate percentage of degrade, but it is not a durable wood and succumbs to the attack of decay and insects, but it may be readily treated with preservatives of the tar-oil group. Under tools the timber works reasonably well in all operations, with only a slight dulling of tool edges, but as it is rather brittle it needs to be pre-bored for such operations as nailing and screwing, and there may be a tendency to split out whilst mortising or drilling. Stoolwood may be considered as a general utility timber for all purposes under cover, and therefore suited for the uses to which such a timber may be put, but protection against any form of fungal attack is vital.

No specific demand exists for the timber, and no such demand is likely to arise outside the areas of immediate exploitation.

Sweetbark

This is a tough and elastic hardwood timber coming from a tree native to Brazil and the neighbouring regions. It is of local importance only, but on account of its resilience it is said to be used as a substitute for Ash or Elm. It is the wood of *Pradosia latescens*, a tree normally of tall growth habit, hence good-sized timbers are not uncommon; the timber has a sweet distinctive taste that has been responsible for its name. The wood is generally straight in the grain, and has a medium or fine texture, whilst its weight may be in the region of 60 lbs. to the cubic foot for air dry stock. The sapwood and the heartwood of average samples of the timber are not at all well delimited, the timber being a whitish or a dull grey in tone, with no distinctive figuring. It is said to be a reasonably durable wood for use in positions where it may be attacked by a wood-rotting fungus, but it succumbs far more readily to sap-stain fungal infection. Reports seem to indicate that the behaviour under tool processes is good, and that surfacing creates no difficulties, whilst the reaction to finishing agents is also good.

Sycamore

This timber is the product of the largest hardwood tree (*Acer pseudoplatanus*) native to the United States of America, and is a hard and dense wood that finds considerable use for internal work that is protected against the weather. It is not a good timber to handle under seasoning treatments, even by air drying methods, and is rather apt to check and split badly during the operation. The wood is not especially difficult to work under tools, has little dulling effect, can be brought to a good surface, and will give satisfactory results on a wood-turning lathe. It reacts well to the normal types of finishing agent used on a timber of its class. Sycamore has an average weight of between 33 and 43 lbs. to the cubic foot, is normally straight grained, and has a fine and even texture. The heartwood of the timber is brownish or yellowish-white in colour, and has a highly lustrous surface. The tree is of the same

genus as that providing the Maples, which timber it closely resembles in its general properties. The timber often referred to in England as the Sycamore is really that of the Plane (see above).

Macroscopic identification features of Sycamore

Definite diffuse porous structure. Growth rings fairly distinct to the naked eye. Vessels small in size; numerous; round in end-section; diffuse distribution; solitary, or in small radial groups. Vessel lines distinct to the naked eye. Rays visible to the naked eye on radial surfaces, but otherwise not particularly marked. Ripple marks not present in the genus. Pith flecks not present.

Tallowwood

The tree producing this timber (*Eucalyptus microcorys*) is a native of New South Wales, Fraser Island, and Queensland, the timber itself being well known and popular on the world markets; it is, of course, related to Jarrah. The wood is remarkably durable when used in exposed positions, and is classified as impermeable to treatment with preservative fluids. It is not a difficult timber to season, though fine cracking may develop during the process, and once the drying operation has been concluded it has a high degree of stability. Tallowwood is a strong timber that is somewhat difficult to work, either in hand or machine processes, and is one that will not glue well on account of its greasy nature. The average weight of the wood when air dry is between 50 and 60 lbs. to the cubic foot, the grain is normally interlocked, and the texture moderately coarse but uniform. The sapwood and the heartwood of the species are not well defined, the timber being dull yellow to light brown in colour, sometimes showing a darker figuring, but it has a uniform tint in any given specimen; the machined wood has a lustrous surface and a greasy feel. Studies of Tallowwood have been made by Baker; Cox; Swain.

Tamarack

This timber—the product of *Larix laricina*—is said to be the strongest of all the softwoods native to Eastern Canada, as well as parts of America. Its natural durability is rather less

than that of the other commercial Larches but the timber reacts satisfactorily to wood preservative processes, either of the tar-oil or soluble salts types. The timber has an average weight that comes within the 20 to 30 lbs. to the cubic foot range when the wood is in an air dry state, the grain is normally straight, and the texture moderately coarse but even. The heartwood of the species is reddish-brown in colouring, and the wood has a noticeable growth ring figuring. Tamarack is not important on the general world markets, but it finds extensive use in Canada, more especially for railway sleepers and structural work. Distortion under seasoning treatments may be quite high unless constant care is exercised. The working qualities of the timber are quite good, but, being coarser in texture than most of the commercial Larch species, it will not turn well; dulling of tools is not particularly marked. Additional notes on the timber will be found in McElhanney, and the entries on Larch above may also be studied.

Tavoy Wood

The timber is the product of a tall tree of Burma and the Malay Peninsula, but the wood is not well known on the world markets, though it can be obtained in fair-sized dimensions. It is mildly decorative in appearance and is therefore suitable for panelling, cabinet making, and similar work. Under seasoning treatments it is rather apt to stain, and needs careful attention throughout the process as it is somewhat liable to checking and splitting. It works well under tools, however, can be brought to a good surface, and responds well to decorative agents. It is only moderately resistant to the attack of decay, but is durable for all purposes under cover. Reddish-brown in colour, with quarter-sawn stock showing a ray figuring, the timber has an interlocked grain and a very coarse but uniform texture, its weight for seasoned wood varying between 45 to 55 lbs. to the cubic foot. It is the timber of *Parashorea stellata*, and a complete study of the wood has been made by Pearson and Brown. No demand is likely to arise for the wood on the world market, but a local increase in demand is not unlikely.

Teak

Teak is the timber of *Tectona grandis*, a hardwood, and may be described as Moulmein Teak, Rangoon Teak, and so on, according to its port of shipment or neighbourhood of origin. The weight is variable between 35 and 50 lbs. to the cubic foot in the air dry state, the grain is normally straight, and the texture very coarse and uneven. It is a light golden brown in colour, sometimes having darker markings, and it has a characteristic smell that is rather like that of leather. Teak is a well known and popular timber that is very resistant to decay when used in unfavourable positions, and it contains an oil that makes it very resistant (but not immune) to white ant and ship worm attack, though the sapwood is somewhat susceptible to infestation by powder-post beetles. It is hard, but not very difficult to work, but it is rated as brittle and needs pre-boring for certain operations; it stains and polishes very well. Typical uses for Teak include the making of furniture, acid tanks, boxes and chests for tropical use, and it is also favoured for use in ship-building for decking and similar work. Amongst others, the following authors may be consulted for further details regarding the wood: Cox; Howard; Pearson and Brown; Stone. Philippine Teak is a true Teak inasmuch as it comes from *Tectona philippinensis*, but it is of very limited occurrence and little commercial importance. In colour it is rather lighter than Burma Teak, and has a grain that is usually slightly wavy, but in its other gross features and qualities it closely resembles its better known relative. In the Philippines the wood is used, when available, as a structural wood rather than as a cabinet timber. The name of Teak is often given to timbers not of the true Teak family (the Verbenaceæ) and often of local importance only. Care should be taken to distinguish between such timbers and the true Teak.

Macroscopic identification features of Teak

Ring porous in structure. The growth rings are distinct to the naked eye and are marked not only by the larger vessels of the early wood but also by layers of terminal parenchyma. Vessels are variable in size, the biggest being quite large and distinct to the naked eye; oval in their end-section; solitary, and in short radial rows or groups; tyloses quite common;

simple perforation plates. Vessel lines distinct to the naked eye, being quite coarse. Rays are normally just visible to the naked eye. Sparse metatracheal type parenchyma, diffuse in distribution; abundant paratracheal parenchyma that is vasicentric round the vessels; terminal parenchyma marks the limit of the growth rings. Ripple marks not present in the genus. Pith flecks not present.

Teak, Malacca

This timber comes from trees native to Borneo, Malaya, Thailand, Sumatra, and other neighbouring regions of Asia, and is a hard and durable wood that shows considerable resistance to white ant attack, though it does not stand up so well to the teredo or limnoria. It is rather a difficult timber to work, and tools need constant oiling as they are apt to clog because of the thick gum deposits in the wood; yet it can be surfaced satisfactorily and will polish well. The timber contains an agent that, like common Oak, causes the corrosion of ironwork fastened into it. Malacca Teak finds use for such items as flooring, railway sleepers, and as a structural wood, and is also of some importance in the dyeing trade. It is somewhat heavier than true Teak, air dry species averaging 50 to 60 lbs. to the cubic foot, is normally straight grained, and has a coarse texture and a dark yellowish-brown heartwood. The timber is produced by various species of *Afzelia*, and is unlikely to achieve any important position on the general timber markets, although it will always be somewhat important locally. Botanically it is a hardwood.

Teak, Rhodesian

Rhodesian Teak is the hardwood timber of *Bankioea plurijuga*; it is reddish-brown in colour in the heartwood, with irregular darker markings, the sapwood and the heartwood not being well distinguished. The grain may be either straight or shallowly interlocked, the texture fine and uniform, and the weight between the 55 to 65 lbs. to the cubic foot range for seasoned wood. Southern and Northern Rhodesia are the homes of the tree producing this timber; the tree is not of tall growth habit (hence timbers are not of large dimensions) and reaches its best development on river banks. The wood is not

difficult to season, surface checking being almost negligible, though a certain amount of warping may occur. Evidence of wood-borer attack may be found in converted wood, but the timber is naturally durable against decay, and shows a marked resistance to termite attack, imitating the true Teak closely in this regard. Rhodesian Teak is difficult to work and dulling of tool edges may be quite appreciable, though it may be finished to a smooth surface, will turn extremely well, and polishes very satisfactorily. The wood is well known on most markets, being regarded as a good substitute for, and used for much the same purposes as true Teak.

Thitka

This timber, sometimes known as Burma Mahogany, is the hardwood product of *Pentace burmanica*, and has an average weight that is between 35 and 45 lbs. to the cubic foot, air dry. The grain of the wood is normally interlocked, and the texture fine and uniform, the heartwood of the species being red-brown in colour, darkening with age and exposure to the atmosphere, with a stripe figuring to be seen on radially sawn surfaces. The tree producing the timber is common in Burma, the Malay Peninsula, and Java, though only in the first named of these countries is it commercially exploited. The timber behaves well under seasoning treatments, and degrade is by no means excessive. It is a naturally durable timber when exposed to the weather or if in contact with earth, but is markedly less resistant to white ant attack. The only difficulty likely to be encountered in the working of the timber is in the surfacing of it; its reactions to finishing agents are good. Typical uses that may be quoted for Thitka include furniture manufacture, interior fittings, flooring, boxes, piano cases, mathematical instruments, boat-building, shop fittings and similar items. Pearson and Brown are amongst the authors who have made studies of the timber, and in their case have given microphotographs of its structure.

Macroscopic identification features of Thitka

Definite diffuse porous structure. Growth rings are not at all conspicuous. Vessels medium sized; not visible to the naked eye; solitary or in radial rows; simple perforations. Rays

homogeneous; not visible to the naked eye; no crystals in the ray parenchyma cells. Very abundant metatracheal type of parenchyma present; sparse paratracheal parenchyma and very thin terminal parenchyma also present. Ripple marks are present and usually very noticeable. Pith flecks are not present.

Tulipwood

Tulipwood, or Tulip Lancewood as it may sometimes be called, is the hardwood timber provided by the *Harpullia pendula*. The tree is of limited availability, and it is not easily exploited. The timber itself is a heavy one, averaging about 60 lbs. to the cubic foot even when fully air seasoned, and it has a grain that may be either straight or shallowly interlocked, whilst the texture is normally fine and uniform. The heartwood and sapwood of the species are sharply differentiated, the latter being broad and whitish in colour, whilst the heartwood has a dark brown background with a tortoiseshell figuring of darker markings. There is no distinctive taste or odour to the timber. The wood is only available in small dimensions, but is frequently obtainable on the market in small consignments, though the price is apt to be high. Tulipwood is said to be naturally durable for use in conditions favouring fungal attack, but is regarded as a cabinet wood rather than as a structural timber, being used for the making of small fancy articles and novelties, mouldings, walking sticks, tobacco pipes, and similar items. A steady demand exists for the wood, detailed studies of which have been made by such writers as Baker and Swain. The wood should not be confused with the American White-wood, sometimes called Tulip Tree or Tulipwood.

Macroscopic identification features of Tulipwood

Diffuse porous type of structure. Vessels are small; solitary, or in short radial rows, the rows being the more common; tyloses are present in the heartwood; vessel deposits also common in the heartwood; simple perforations. Vessel lines usually just visible to the naked eye. Rays are not distinct to the naked eye but are visible under a hand lens; not distinct on radial surface; heterogeneous in type. Vasicentric type of parenchyma surrounding the vessels, and some aliform

parenchyma is also present, sometimes showing a tendency to being confluent. Ripple marks not present in the genus. Pith flecks not present.

Turpentine

This Australian timber is the product of a species of tree (*Syncarpia laurifolia*) of Queensland and New South Wales. The wood is somewhat refractory under seasoning treatments, and collapse is a common condition with kiln seasoned woods of the species, but the timber may be restored to its original size and shape and quality by steam reconditioning treatments. Turpentine is hard and dense, and is naturally resistant to the white ant and teredo, as well as to the onset of decay; it is also said to be resistant to fire hazards. The heartwood of the species is reported to be impermeable to treatment with preservative liquids. The wood has a gritty surface but is not really difficult to work in any operation, and it may be turned and bent satisfactorily; it will polish well. Average specimens of the timber should weigh between 55 and 60 lbs. to the cubic foot, the grain should be wavy, and the texture medium coarse but uniform; the heartwood of the species is reddish-brown in colour, whilst quarter-sawn stock will show a ray figuring. For additional information regarding Turpentine see studies by Baker and by Swain. Among the normal uses to which the wood may be put, railway sleepers, dock works, wagon- and ship-building, may be mentioned.

Macroscopic identification features of Turpentine

Diffuse porous in structure. Vessels small; numerous; solitary; tyloses and vessel deposits are present; simple perforations. Vessel lines fine but usually distinct to the naked eye. Rays are heterogeneous; not visible to the naked eye and usually only just visible under a lens on transverse section; conspicuous on radial surfaces; deposits present in ray parenchyma cells. Wood parenchyma sparse; not visible to the naked eye and not distinct under a lens; paratracheal and diffuse in type. Ripple marks not present in the genus. Pith flecks not present.

Walnut, African

African Walnut may also be known as Nigerian Walnut, Amonilla, or Benin Walnut. It is the timber of *Lovoa klaineana*, a hardwood, and has an average weight of from 30 to 40 lbs. to the cubic foot when air dry. The grain is normally interlocked, with the texture fine and uniform, whilst the heartwood is a typical walnut brown in colour, having a figuring of darker markings, with a striped figure on quarter-sawn surfaces. The timber is one that kiln seasons well with only a low rate of degrade, and whilst the sapwood is said to be susceptible to powder-post beetle attack, the timber as a whole is regarded as being more naturally resistant to the attack of fungi than is English Walnut. African Walnut works fairly easily under hand or machine tools, without any great dulling of tool edges, and responds well to most types of finishing treatments. It usually reaches this country in the form of short logs which may be found to have been attacked by wood-boring insects. Typical uses for the timber include panelling, flooring, furniture, billiards tables, cabinet making, veneers, high-class joinery, and numerous similar items.

Macroscopic identification features of African Walnut

Diffuse porous in type. Growth rings either not very distinct or invisible. Medium sized vessels that are distinct to the naked eye; evenly distributed; solitary, or in small radial groups; simple perforations; dark gum deposits very common. Vessel lines usually visible to the naked eye. Rays fine; usually just visible to the naked eye on transverse section; deposits are usually to be found in the ray parenchyma cells. Occasional tangential lines of wood parenchyma, though these may not be well marked; terminal, paratracheal and meta-tracheal types are all present. Ripple marks not present in the genus. Pith flecks not present.

Walnut, Australian

This North Queensland timber (also known on certain markets as Queensland Walnut, Australian Black Walnut, and Walnut Bean) is one of the most popular Australian hardwood timbers to reach the general consumer, and it is normally quite freely exported. It is the timber of *Endiandra palmerstoni*,

has a grain that is either straight or wavy, with a very fine and uniform texture. The weight of average samples runs between 45 and 50 lbs. to the cubic foot; sapwood and heartwood of the species are not sharply distinguished, the wood being darkish brown with darker irregular streaks, with quarter-sawn timber showing a broken striped figuring; the wood has a mild unpleasant smell. Australian Walnut is difficult to work, but peels or slices satisfactorily for veneers, and is capable of taking a high polish. The timber is rather awkward to handle under seasoning treatments, and is not a naturally durable one when used in situations unprotected from the weather. It is a typical cabinet wood, being used for such purposes as turnery, cabinet making, furniture, interior fittings, panelling, veneering, and so on. For studies of the timber see amongst others Baker; Cox; Howard; Swain.

Macroscopic identification features of Australian Walnut

Diffuse porous in structure. Vessels are evenly distributed and medium sized; solitary, and also arranged in short radial rows; tyloses very common; dark brown deposits are present; simple perforation plates. Vessel lines distinct to the naked eye. Rays heterogeneous; distinct to the naked eye on transverse section; conspicuous on radial surfaces. Occasional paratracheal type of wood parenchyma present; metatracheal parenchyma in the form of irregular bands present, and visible to the naked eye. Ripple marks not present in the genus. Pith flecks are not present.

Walnut, Black

The tree producing this timber (*Juglans nigra*) reaches its best development in the Ohio River Basin, and under favourable conditions may reach a height of 150 feet (with a diameter of 6 to 7 feet), being a member of the true Walnut genus. The timber is well known and popular on the world markets, but it has been so freely exploited in the past that supplies now tend to diminish year by year, and consequently, to become rather expensive. It is considered more durable and harder to work than is English Walnut, though it is used for much the same purposes as that timber, *i.e.*, for cabinet making, veneers, furniture, internal fittings, mouldings, plywood, piano

cases, and similar items. The average weight of the wood falls between the 40-50 lbs. range for the cubic foot, the grain is generally straight, and the texture coarse: it is markedly stable after seasoning. The heartwood of the species may run from a chocolate brown to a deep purple in colour, with a simple figuring, and a slight distinctive smell. See Hale; McElhanney; Sargent.

Macroscopic identification features of Black Walnut

Conform generally with those of the English Walnut below.

Walnut, Blush

Blush Walnut is a rather heavy timber (average weight between 50 and 60 lbs. to the cubic foot), has a straight grain, and a texture that is variable from fine to medium coarse but uniform; the heartwood is yellowish-brown to pinkish-brown in colour. The timber comes from an Australian tree (*Beischmedia obtusifolia*) to be found in Queensland and New South Wales, but it is not of the true Walnut family. It is a moderately durable wood that is best suited for use in protected positions, and is accordingly used for such items as flooring and interior fittings. The timber turns well, and is therefore employed for the manufacture of certain classes of turned articles. The wood may be regarded as being primarily of local interest only, with little likelihood of any demand arising for it except from local consumers. See additional notes on the timber by Baker and by Swain.

Walnut, East Indian

This is the timber of *Albizzia lebbek*, and may be known as Kokko, or, in India, as Siris. It is a hardwood with a weight of between 35 and 45 lbs. to the cubic foot in an air dry state, with a grain that may be either straight or shallowly interlocked, and having a medium coarse texture. In some parts of tropical America the tree is sometimes given the unusual name of the "Woman's Tongue Tree" because of the constant rustling of the leaves; the tree is of rapid growth but short life, and is widely cultivated in India, Indo-China, North Africa, and so on. East Indian Walnut does not create undue problems in seasoning, but heart shakes are rather common in the converted

stock. It is not a naturally durable wood for use in exposed positions, and the sapwood is very susceptible to insect attack. The wood is not always easy to work by hand, but it carves well and reacts satisfactorily to the normal types of finishing treatment. It may be regarded as a mildly ornamental cabinet wood of more than local importance.

Walnut, English

Walnut is one of the best known hardwoods in the world, and is deservedly popular as a high-class furniture wood. The tree (which is of long and tall growth habit) that provides the wood is common in southern Europe and parts of Asia, being extensively cultivated for its fruits, whilst the timber also reaches the market under such descriptions as French, Spanish, Circassian, Italian, Turkish or Persian Walnut. The wood requires a considerable degree of care during seasoning processes, as otherwise fine splits may develop during the drying. It is a moderately easy wood to work, turns and peels for plywood well, and carves very satisfactorily; it also stains and polishes excellently. It is in considerable demand for all sorts of cabinet work, furniture, panelling, gun stocks, and so on, and at present the demand for seasoned timbers outweighs the available supplies. It has a deep brown to blackish coloured heartwood, that may be streaked with darker figurings, and a slight distinctive smell. The grain is generally straight, but the texture medium coarse, whilst the wood has an average weight of between 38 and 48 lbs. to the cubic foot. The timber is provided by the *Juglans regia*. Studies of the timber have been made by Chalk and Rendle; Howard; Pearson and Brown, and Winn, amongst others.

In addition to the American Walnuts described above the Japanese Walnut (*Juglans mandishurica*) also has a certain amount of importance as a timber.

Amongst the timbers also described as "Walnut" (though not members of the Walnut genus) may be mentioned the South American variety (*Enterolobium cyclocarpum* of the Leguminosæ), a moderately light hardwood used locally for cabinet making, and the Brazilian Walnut (or Embuia), which, coming from species of *nectandra* is closely related to Greenheart. This last timber finds use locally as a sleeper wood and structural timber, as well as a cabinet wood.

Macroscopic identification features of English Walnut

Normally is diffuse porous though there may be a tendency towards a ring porous structure. Growth rings sometimes distinct to the naked eye, but not always so; boundaries of growth rings are marked by fine lines of terminal parenchyma. Vessels medium-sized; mostly solitary, but may also be in short radial rows; tyloses normally present; simple perforation plates. Vessel lines medium coarse and are distinct to the naked eye. Rays fine; usually visible to the naked eye; mostly homogeneous; rays form inconspicuous fleck on radial surface; crystals are not seen in the ray parenchyma cells. Abundant metatracheal type of parenchyma present; sparse paratracheal parenchyma and the terminal parenchyma that marks the growth rings also present; no crystal deposits in the wood parenchyma cells. Ripple marks not present in the genus. Pith flecks not present.

Walnut, Satin

Satin Walnut has such alternative names as Red Gum, Hazel Pine, and Sap Gum. It is the hardwood timber of *Liquidambar styraciflua*, having an average weight of 35 lbs. to the cubic foot, with an irregular grain, but a fine and uniform texture. The heartwood of the species may range from light to dark brown, with a figure produced by irregular black markings, whilst the sapwood is grey or yellowish in tint. The timber is available in wide sizes, and a considerable quantity of it is sold in the form of thin sanded panels. It works easily, turns and carves well, and may be satisfactorily polished. During seasoning it is liable to develop warps, and it is not naturally resistant to the attack of wood-rotting fungi when used in unprotected positions. Cabinet making, veneers and furniture manufacture are the principal uses to which Satin Walnut is put, but the timber has some importance in the making of machine-cut and embossed carvings. See additional notes on the timber by Howard; Record and Mell.

Macroscopic identification features of Satin Walnut

Definitely diffuse porous in structure, with the growth rings not at all distinct to the naked eye. Vessels very small; numerous; not visible to the naked eye but distinct under a hand

lens; tyloses present; scalariform perforation plates. Vessel lines fine and not distinct to the naked eye. Wood parenchyma not visible either to the naked eye or under a hand lens. Vertical gum ducts are sometimes present. Ripple marks not present in the genus. Pith flecks not present.

Whitewood, American

This well known timber is the product of a tree native to the eastern half of the North American continent, and is readily obtainable on the world markets in the form of wide boards. The wood is soft and works well under hand or machine tools, being especially useful for carving. Whitewood will not polish satisfactorily, but takes paint and stain well. No especial difficulties are encountered during the seasoning of the wood, which is the product of *Liriodendron tulipifera* of the natural order Magnoliaceæ. The timber may also be known as Yellow Poplar, Canarywood, and Basswood (not to be confused with the timber of *Tilia glabra*). Light in weight, the wood averages from 25 to 30 lbs. to the cubic foot in the air dry state, the texture is fine and uniform, and the grain usually straight; the heartwood is a dark yellowish-brown, brownish or almost purple in colour, the sapwood being whitish to pale yellow. American Whitewood may be summed up as being a useful non-ornamental general utility wood of considerable economic importance.

Willow

Willow is a hardwood that is provided by various species of *Salix*, and has an average weight of 28 to 38 lbs. to the cubic foot according to species, a straight grain, fine and uniform texture, and a light red-brown coloured heartwood with a whitish sapwood. The wood is very likely to be mistaken for that of Lime, Poplar (to which it is botanically related) or Horse Chestnut. It is the product of a common enough tree, but the timber itself does not rank as important on the markets. Willow is rated as only moderately durable when exposed to the weather, but is not of the class of timbers normally given a preservative treatment. The working qualities of the timber are quite good, but the uses to which it may be put are somewhat limited. They include fancy articles, poles, athletic

goods, hoops, turned articles, agricultural implements and inlaying. It is unlikely that the demand for the wood will ever exceed the possible supply. For details of the anatomical structure of the wood and a microphotograph of its end-section see Chalk and Rendle. The Black Willow (*Salix nigra*) provides the timber of the best dimensions, whilst the Indian Willow (*Salix tetrasperma*) also has a local commercial importance.

Macroscopic identification features of Willow

Diffuse porous in structure, with the growth rings quite distinct to the naked eye. The vessels are many in number but small in size and not normally distinct even under a hand lens, but gum deposits are frequently present. The vessel lines are very fine and not distinct to the unaided eye. Rays numerous and fine; cannot be seen even with the help of a hand lens. The positive identification of this timber is best made on the microscopic and not the macroscopic features.

Yellowwood

As is the case with so many other timbers, Yellowwood is a very common name applied to vastly different species. Four varieties of these are dealt with below.

Australian Yellowwood is the timber of *Flindersia oxleyana*, and is a hardwood timber, lightish to a pale yellow-brown in colour, with no characteristic taste or smell, a grain that is generally interlocked, and a fine and uniform texture; average specimens weigh from 45 to 50 lbs. to the cubic foot, air dry. It is of more importance locally than it is as a factor in the world's timber production. This particular wood works reasonably well in all hand or machine operations, bends satisfactorily, but it is not naturally durable when exposed to the weather or if in contact with the soil. It is used in Australia for such purposes as flooring, linings, tool handles, and bentwood work.

Brazilian Yellowwood, also known as Yellow Mahogany, is a hardwood timber having an average weight of about 37 lbs. to the cubic foot, a grain that is normally straight, and a medium coarse texture; it is the timber of *Plathymenia reticulata*, and is commonly used for furniture making, etc. The wood is extremely popular locally but the tree is not too abundant, and this combination of factors results in the wood being seen on the

general market only at infrequent intervals. With seasoning the wood creates few problems, and is durable when the process is completed, whilst it also works well under tools.

South African Yellowwood is provided by various species of *Podocarpus* that produce a locally useful general utility timber that is not difficult to work, whether by hand or machine, and seasons remarkably well both by natural and by heat methods. Average timbers weigh from 25 to 35 lbs. to the cubic foot, and the grain is normally straight with the texture very fine and uniform. The sapwood and the heartwood of the species are not sharply distinguished, the timber having a light yellow tint with no figuring.

The American Yellowwood is the timber of *Cladastria tinctoria*, and may be sold on the North American continent as Gopher Wood. It has the yellow tint characteristic of all timbers sharing the vernacular name of Yellowwood, and the working and seasoning qualities are quite good, but the wood is of little commercial importance.

Yew

Species of Yew are indigenous to Europe, Asia and the western hemisphere, producing a wood that is well known on the timber markets. The wood is not readily obtainable in large sizes, and may warp considerably in seasoning. Like all the softwoods, Yew is immune to powder-post beetle attack, but unlike the majority of coniferous timbers is rated as durable when used in exposed positions. The working qualities are good, whether under hand or machine operations, and the timber gives satisfactory results with most of the normal kinds of finishing agent. Yew is provided by different species of *Taxus*, has a grain that is either straight or shallowly interlocked, a fine and uniform texture, and an average weight of between 33 and 43 lbs. to the cubic foot, when air dry. The heartwood is a light red to a deep brown in colour, some specimens showing an indistinct figuring of darker streaks.

Macroscopic identification features of Yew

Softwood, with the growth rings distinct to the naked eye and the boundaries marked by dark lines of flattened tracheids, Tracheids medium fine; change of size from early wood to

late wood only gradual, but a spiral thickening of the tracheids is present. Rays are not distinct to the naked eye. Resin canals and resin ducts are not present in the species.

Zebrawood

Locally, this is not an uncommon name, but only two of the many timbers given this title will be dealt with here. The first of these timbers comes from French Guiana where it is probably better known as Bois Serpent, though it is also given the title of Surinam Snakewood. It is the product of *Pithecolobium racemiflorum*. Being only of rare occurrence in the forest the tree is of local importance only, although it provides a useful cabinet wood. It is a very heavy timber even when fully seasoned, is straight grained, and shows a medium coarse texture. In colour the wood is a light brown with an irregularly striped figuring. In all tool processes the wood cannot be described as easy to work, but it may be brought to a good surface and reacts satisfactorily to most finishing agents. For a full description of this particular timber, including its botanical structure, see Record and Mell. The second species of Zebrawood is a little known cabinet wood of the Connaraceæ family, being the product of a small tree, the *Connarus guianensis*. It is a lightweight hardwood that has good working and finishing qualities, though only moderately durable. It is chiefly noteworthy for its beautiful and distinctive figuring, consisting of a striping of dark reddish-brown on a creamy background.

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The following is a list of books that will be found to be of considerable use to the student of wood technology, though it cannot, of course, claim to be a complete list of such books. In addition to the volumes dealing with separate species or timbers of a geographic region, others of a more general nature have been included. If out of print, or otherwise unobtainable, most of these books are to be found in Public reference libraries.

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In the text an alphabetical arrangement has been used to list each timber under its most common trade name. Such names have not been included in this Index, which has been confined to botanical and alternative trade or local names. Botanical names are shown in italics and others in ordinary lettering.

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